

12

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'MAGAZINE OF BOTANY AND ZOOLOGY,' AND OF
LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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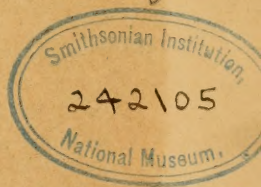
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VOL. V.—SECOND SERIES.  
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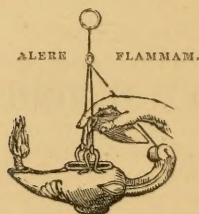
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“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—
LINNÆUS.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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ERRATA.

- Page 353, line 3, *for* misdated *read* misstated.
— 362, line 26, *for* corde *read* corda.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollice virgineo teneros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo.”
N. Parthenii Giannettasii Ecl. 1.

No. 25. JANUARY 1850.

I.—*Observations on the Conjugation of Closterium Ehrenbergii.*
By the Rev. W. SMITH, F.L.S.

[With a Plate.]

THE conjugation of *Closterium Ehrenbergii* (Menegh.), under the name of *Closterium lunula*, has been described in a paper by M. Morren, ‘Annales des Sciences Naturelles,’ 2nd ser. tom. v. 1836, but the phænomenon does not appear to have met the eye of any late observer in this country, and is wholly unnoticed by the acute and careful authors of the ‘British Desmidiæ.’

I have had an opportunity, during two successive seasons, of noticing the circumstance in question, and the facts elicited seem to vary in some important respects so materially from those recorded by M. Morren, and are in themselves so different from the ordinary phænomena which accompany the conjugation of other *Closteria*, or indeed of any other of the *Desmidiæ*, that I have thought it might be interesting to those engaged in such investigations to state the particulars which have fallen under my notice.

On the 23rd March 1848, I first discovered *Closterium Ehrenbergii* in a state of reproduction. On this occasion the period of conjugation had evidently nearly expired, as but few individuals were in that condition, and the mucus stratum, which results from the aggregation of conjugating fronds, had almost wholly

disappeared. On the 29th of January 1849, I again, in a different locality, met with conjugating fronds, and on this occasion in great abundance and in very perfect condition. Conjugation was evidently but just commenced, the mucus envelope was general, the fronds exhibited the peculiar condition of the internal granular mass which betokens the approaching change, and were in those relative positions which, as will be seen hereafter, indicate a tendency to unite in the formation of sporangia. A few days later, multitudes of individuals were found in every stage of conjugation, and the process continued until the beginning of March, towards the middle of which month few perfect fronds could be discovered, and the sporangia, hitherto in vast numbers, were fast disappearing: the mucus which held them in suspension, and floating on the surface of the water, having become dissolved, they were only to be discovered upon a very careful search, entangled in the filaments of other plants or mixed with the earth at the bottom of the pool. At a later period, and in the locality of 1848, I found a few conjugated fronds on the 7th of May 1849.

The period of conjugation of this species would therefore appear to be during the first three or four months of the year. M. Morren has noted it to occur in April, and again in June, remarking, that probably two generations had lived in this interval. This opinion does not however seem to be borne out by the facts I have observed, as in no case have I been able to detect the plant in the same locality for more than a month or six weeks at one time, nor has it ever reappeared in any quantity in the same pool. I have occasionally found single fronds of *Closterium Ehrenbergii* in running water, but on all the occasions previously mentioned, it has occurred in clear shallow pools or marshes formed by springs on the open moorlands between Wareham and Corfe Castle.

I proceed to notice the phænomena of conjugation as they successively presented themselves. The first is an alteration in the granular condition of the endochrome. This, from a light yellowish green, passes to a much darker shade, and the larger granules or "diaphanous vesicles" of Ralfs, which were originally few in number and arranged in a somewhat irregular longitudinal series (Pl. I. fig. 1), become exceedingly numerous and pervade the entire frond. While this change is about taking place, the fronds approach in pairs, approximating by their concave surfaces, and finally coming into such close neighbourhood that their inflated centres are in contact and their extremities slightly overlapped (fig. 2). In a short time, probably in the course of twenty-four hours, a remarkable change takes place both in the appearance and condition of the fronds; a mass of

delicate mucus is secreted around the approximated fronds; these remove to a little distance from each other, undergo "self-division," and present altogether an irregular oval figure, the outline of which is formed by the periphery of the mucus, the four divisions of the fronds being placed in the middle in a somewhat quadrilateral manner (fig. 3). During the progress of self-division the internal membrane of the cell-wall becomes enlarged at the suture or line of separation, and projects in the form of an irregular cone with a blunt or rounded apex forming a beak, whose side view presents a triangular outline. This beak becomes filled with endochrome, either by the dilatation or increase of the contents of the half-frond, and the divided frond assumes the appearance of one with two unequal segments, being what M. Morren calls "*une Closterie à deux cones inégaux*" (fig. 3). On these membranous expansions, at the concave surfaces of the fronds and close to the original sutures, there appear, almost simultaneously with the formation of the beaks, two circular projections, which rupturing at their apices, give egress to the delicate sacs which inclose the endochrome, and which drawing with them their contents and meeting with the endochrome-sacs emitted through similar projections from the other half-fronds, form by their connection irregular masses which quickly consolidate and assume the appearance of perfectly circular, smooth dark-coloured balls, the sporangia of Ralfs and seminules of Morren (figs. 4, 5).

The discharge of the endochrome and formation of the sporangia are accomplished with much rapidity, and may often be seen taking place in the field of the microscope, the whole operation not occupying more than a few minutes. It will be seen from an inspection of the figures, that during the formation of the sporangia there appears to be a second development of mucus in the form of rings around the reproductive bodies; this is probably only the effect of the pressure produced by the growth of the sporangia on the mass of investing mucus. It will also be seen that the pale transverse band adopted by Ralfs as a character of the genus *Closterium*, and which in figs. 1 and 2 occupies the centre of the undivided frond, is, upon self-division taking place, removed a little towards the extremities of the half-fronds (fig. 3). The reason as well as the cause of this motion I am unable to explain, but it seems to confirm the propriety of adopting the band itself as a permanent and important character.

With regard to the subsequent changes which take place in the sporangia, the time which elapses before they produce young fronds, and the mode in which such evolution of a fresh race is accomplished, I have not been fortunate enough to ascertain any-

thing with certainty. I preserved a mass of the conjugated fronds and multitudes of the perfect sporangia in water, which I frequently changed, for more than four months, but could not detect any appearance of young fronds, nor did I notice any material change in the sporangia until decomposition supervened with the increased temperature of the season.

M. Morren contends that a sporangium becomes converted into a single frond, and gives a series of figures in illustration of the changes which the sporangium undergoes until it becomes "une Closterie à deux cones inégaux" (fig. 7 *a, b, c, d*). Now as I have shown that this form is the result of the self-division of the ordinary frond and invariably precedes conjugation, I am disposed to think that M. Morren has mistaken fronds thus divided, and afterwards thrown out of their relative positions, for modified sporangia. Certain it is that among myriads of conjugated fronds and their sporangia I have been unable to trace the gradations figured by M. Morren, nor have I on any occasion detected the slightest modification in the sporangia after their full maturation. A divided frond smaller than the others, or one in which the self-division has been arrested, may occasionally be discovered, but the very rarity of such examples precludes the idea that such forms result from the normal development or growth of the sporangia.

How the species in *Closterium Ehrenbergii* may be renewed, appears still involved in the same uncertainty as that which envelops the propagation of every other species of *Desmidiæ*. Self-division in the case before us seems only to accompany conjugation, and will not, as in the other *Desmidiæ*, account for the existence at certain periods of vast multitudes of the fronds. Another mode of increase, analogous to the propagation by zoospores in *Sphaeroplea crispa* and other Algæ, has been assigned to the *Desmidiæ*, and it has been alleged that the endochrome escapes in the form of zoospores, and becomes transformed into new fronds. M. Morren not only affirms this to be the case, but gives a figure illustrative of the conversion of these zoospores, or as he terms them "propagules," into new fronds. Mr. Ralfs merely observes that the escape of the granular contents of the mature frond is *probably* one mode by which the *Desmidiæ* are increased. He however regards the "swarming of the granules" (a curious circumstance observable in the *Desmidiæ* and other Algæ, and which I am disposed to regard as a disturbance attendant upon the decay of the granular mass) as identical with the movement of the zoospores, and after accurately describing the phenomenon, goes on to state, that with the history of these granules after their escape from the frond he was altogether unacquainted. Mr. Ralfs afterwards gives a figure (British Des-

midieæ, pl. 27), upon the authority of his coadjutor Mr. Jenner, representing the bursting of the sporangium and the growth of the young fronds from its contents in *Closterium acerosum*, so closely resembling the figure by M. Morren of the conversion of the propagules of *Closterium Ehrenbergii* into young fronds, that I cannot but believe a similar phænomenon to have been noticed by both observers, and am inclined to accept the view of Mr. Jenner as the correct one, and to regard propagation by zoospores or "propagules" as one not yet satisfactorily established in the *Desmidiæ*.

Increase by self-division, where a single frond separates into two equal parts, and generates at the suture two new segments respectively attached to the old, and thus forms from itself two perfect fronds, is one mode by which these minute organisms multiply with amazing rapidity; but this is merely a repetition or increase of the individual; the species must be renewed by another method, and that I believe to be the result of conjugation, or in other words, the conversion of the sporangial contents into young fronds; the subject however still requires elucidation from the cautious and skilful use of the microscope.

I may remark in conclusion, that in a generic arrangement, based upon the reproductive organs, *Closterium Ehrenbergii* will stand apart from all other *Desmidiæ*. In it alone a pair of conjugating fronds produce two sporangia. It is however allied to others of the present genus through *Closterium lineatum*, the sporangium of which, according to Mr. Ralfs, is binate, and shows a disposition to separate into two parts.

Wareham, November 1, 1849.

EXPLANATION OF PLATE I.

Fig. 1. A single frond of *Closterium Ehrenbergii* in its ordinary condition.

Fig. 2. Two fronds approaching and in the apposition which precedes conjugation.

Fig. 3. Conjugating fronds undergoing self-division, the upper showing the protuberances through the torn apices of which the contents of the divided fronds pass into the sporangia.

Fig. 4. Conjugating fronds showing the passage of the endochrome-sac and its contents.

Fig. 5. Conjugated fronds having perfected their sporangia.

Fig. 6. Development of the "propagules" into young fronds (after Morren). Compare with the figure given in the 'British Desmidiæ,' pl. 27, of the conversion of the sporangial contents into young fronds in *Closterium acerosum*.

Fig. 7. a, b, c, d. Development of a sporangium into "une Closterie à deux cones inégaux," from Morren.

The figures are all magnified 100 linear. Length of ordinary frond $\frac{7}{8}$ of an inch; greatest breadth of ditto $\frac{1}{8}$; length of divided frond $\frac{1}{8}$; length of beak $\frac{1}{8}$; diameter of sporangium $\frac{1}{8}$.

II.—On the *Terebrating Mollusca*.

By WILLIAM CLARK, Esq.

To the Editors of the *Annals of Natural History*.

GENTLEMEN,

Norfolk Crescent, Bath, Oct. 12, 1849.

“Scire tuum, nihil est, nisi te scire hoc, sciat alter.”

THIS quotation, from one of the most sagacious of the satirists, is not meant to be applied here, as A. Persius employs it, to lash the inordinate vanities of authors craving to have their lucubrations committed to the press, but in its simple sense, as an incontestable aphorism, that unless we communicate our ideas and what we know to others, our knowledge is vain and nought. In conformity with this application of the sentiment above, I propose to state some important facts which I believe at present are not generally known relative to the boring *Pholades* and other *Acephala*, and particularly on the identity of *Pholadidea papyracea* and *Pholas lamellata* of authors, together with some curious facts in the organization of the Bivalve Mollusca.

To carry out these views, it will in the first place be necessary, to enable malacologists to form just conclusions on the matters I have sketched out, to furnish them with a correct account of the animals of *Pholadidea papyracea* and *Pholas lamellata*, accompanied by a short summary of comparison, after which I trust I shall be able to place the *vexata quæstio* of the boring functions of the *Acephala* on the irrefragable bases of certainty; and lastly, I shall communicate a most curious fact connected with the testaceous *Acephala*, which, if hitherto unknown and now established, must be considered most important, inasmuch as it will add a function of the first consideration to the œconomy of these animals.

Pholadidea papyracea, Brit. Moll.*Pholas papyracea*, auctorum.

Animal elongated, subcylindrical; mantle closed, except a small rayed aperture for the foot, as long as one exists, and which corresponds in position with a similar aperture in the membrane connecting the doming of the shell, and is styled by Dr. Turton a “spiracle,” but which may perhaps in this species, the only one of the *Pholades* that has it, be for the purpose of a partial issue, or rather protrusion, without the solution of continuity of the ventral membrane of the animal, of the hyaline cylindrical appendage which exists in all bivalves, to secure for it a point of support when the foot becomes so much diminished as not to afford one. In all other bivalves this stylet is not visible, being imbedded in the body and upper part of the pedicle of the foot, which is the leaning-stock or point of resistance,

except in the *Anomiæ*, *Ostreæ* and *Pectinidæ*, in which, as the foot is reduced almost to nothing, the mass of the body is the only *point d'appui*; but when the dome of the shell of the *Pholadidea papyracea* is removed, the dark basal point of the stylet presents itself in the centre of the mottled belly, precisely where the foot is placed in the group of the *Pholades*, and in this case it appears to act as a substitute.

The siphonal apparatus consists of a long elastic sheath, which is often protruded to double the length of the shell, but in a state of half-extension it becomes highly corrugated; it is clothed with a dull red-brown epidermis, under which it is bluish white; the margin of its terminus is finely fringed with short white cirrhi; within the sheath are the anal and branchial tubes, the former with the margin quite plain, but exserts a tubular hyaline process; the latter is encircled by about twenty white cirrhi of different lengths.

The liver is green, and situated as usual on the dorsal range. There are on each side the body a pair of pale reddish brown elongated suboval branchiæ, the upper one being much the smallest, which are finely striated on the outer surfaces; their posterior extremities suddenly become linear, and are then deposited in the branchial tube; there are also two long flat linear palpi on each side, with lanceolate points; these are more striated than the branchiæ. The body is centrally subglobose, but tapers posteriorly and anteriorly to a blunt terminus, and the whole of it presents, especially in the genial season, a mottled mass of flaky white subrotund spots or dots, with one of the termini of the elastic appendage appearing in the centre of the anterior extremity. With regard to the foot, as I have already observed, not a trace is visible, having vanished for reasons to be spoken of in another place.

Pholadidea papyracea, Brit. Moll.

Pholas lamellata, auctorum.

Animal nearly of the form we have just described; mantle closed, except a large aperture for the passage of the foot, which in this form of the *P. papyracea* is most apparent. The branchial processes and siphonal tubes are, in the *most minute points*, similar to those organs in the form styled *Pholadidea papyracea* to which we refer; the body, as in it, is subglobose, and produced posteriorly and anteriorly to an obtuse point, and it is generally of a bluish hyaline colour, with some fine anastomosing lines throughout its surface, but has nothing of the mottled appearance of *Pholadidea papyracea*; the shape of the branchiæ is the same as in its congener, but their striæ are more delicate and colour of the palest yellow; these are the mere variations of adolescence, and generally prevail where specific identity cannot be

doubted, and they are deposited partially as in its congener, in the branchial tube; the palpi and liver exhibit no variation. I now come to the most decided difference between the two animals; the foot, in the form we are now describing, is proportionally larger than in any other of the *Pholades*, of hyaline texture, springing from the centre of the body with a long cylindrical pedicle; it has a subclavate appearance, truncate at the terminus, which is of suboval form and pointed antecially and postecially, and there is no outward visible trace of the curious elastic stylet common to all bivalves, and so conspicuous in the ventral tissue of the form *Pholadidea papyracea*.

I will now make a short comparison of the two forms: it will be observed that it is stated, in the form *Pholadidea papyracea*, that the mantle is closed, except a very small aperture or "spiracle" for the foot, if it still exists; but in the form *Pholas lamellata* there is a large aperture for a foot, that is, larger in proportion than in any of the *Pholades*. The branchiæ, palpi, and elaborate siphonal apparatus are precisely the same with only variations of colour; the bodies of the two are of the same shape, but differ in colour and markings, the one being intensely mottled, the other hyaline; the body of the one having *no* foot attached to it, but the other a very *large* one. These are the principal variations, and certainly constitute a very general difference of aspect between the animals of the two forms, and it must be admitted that conchologists and even malacologists, who have not examined with care all the conditions and incidents attached to them, have had a *primâ facie* case for doubting their identity; but notwithstanding these great and visible discrepancies, I think I shall, by a suite of facts, observations, and reasoning thereon, be able decisively to settle their specific identity.

But before I apply to this discussion, I propose to communicate what I consider to be the real agent of the Acephalous Mollusca in the operation of excavating their dwellings. This abrupt inroad on a subject only just mooted, will however, from the facts adduced, shorten the discussion when we revert to the subject we have for the moment abandoned, as they will I think satisfactorily account for some of the great variations of aspect between the *Pholadidea papyracea* and the so-called *Pholas lamellata* and other apparent anomalies. I disclaim all merit for the great discovery of the animal functions that are the principal agents of the excavating powers of the Acephala, and which will I think for ever set at rest the endless discussions thereon, by placing the subject on the indestructible bases of certainty.

This great result is due to the genius and talents evinced by Mr. Albany Hancock, in his paper in the 'Annals' of October 1848, "On the Boring of the Mollusca into Rocks." If any considerations are due to me, they are of the most negative character,

and only consist in the circumstances, that during the summers of 1848-9 I sedulously for several weeks examined the *Pholades*, both *in situ* and in the closet, when after a careful investigation I arrived at the same conclusions with respect to the boring agents of the bivalves as Mr. Hancock; and I have the notes of them now by me, written before Mr. Hancock's publication, which I intended to lay before the public; that gentleman has anticipated me, the whole merit is his, and I cordially apply to him the motto, "*Palnam qui meruit, ferat.*" I will now state some facts which perhaps have escaped Mr. Hancock's attention, corroborative of his positive discovery.

I revert for a moment to the consideration of the identity of *Pholadidea papyracea* and the *Pholas lamellata* of authors, on which point Professor Forbes and Mr. Hanley, in the 'British Mollusca,' have concurred, having in some measure relied on my authority communicated many years ago. The investigation in the last summer (1848) was undertaken by me both with the view of making an attempt to discover the terebrating powers of the *Acephala*, particularly of the *Pholades*, and for further proofs of the identity of the two forms styled by authors *Pholadidea papyracea* and *Pholas lamellata*.

In the course of my examinations I was startled by the great variations in the organs of the two forms of this *Pholas*, which, twenty years ago, when I first examined this species, appear not to have so rigorously excited my notice; doubts arose in my mind, that I might be wrong in my former determinations of identity, and I wrote to Dr. Battersby to express them to him and Mrs. Griffith, both of Torquay; the latter a lady naturalist, who has taken great interest in this question; but in the present summer of 1849, after a continued investigation of fourteen weeks, my doubts were dispelled, and I stated personally to Dr. Battersby, that after a careful review of all the evidences that presented themselves, I reverted to and relied on my original determinations of identity of the two forms of *Pholadidea papyracea*.

This change of opinion arose from the observation that in the adult *Pholadidea papyracea*, the mottled appearance of the belly, so dissimilar to that of the form *Pholas lamellata*, was due to the extension of the reproductive membranous organs of the ovary and the spermatozoa, occupying the space usually appropriated to the foot, which I found had disappeared. This anomalous appearance excited my attention, and the reflection that with nearly absolute *cæteris paribus*, in the generalities of all the *Pholades*, there was no substantial reason why one species should always be deprived of the foot, when all the others possessed that appendage, and as I had come to the conclusion, that it was the boring instrument, I felt assured that this anomaly was only

an apparent one, dependent on certain conditions connected with the growth of the animal ; and as the very large anterior gape in all the *Pholades* is the site of the powerful foot, and is never closed up during their existence, except in this species, I became fully convinced, that the foot,—having finally performed its terebrating functions, the animal consequently having arrived at full growth (the test of which is the doming and formation of the caliciform incipient tubing, which is in *Pholadidea papyracea*, the last vestiges of the protecting tubes of the *Teredinidæ*)—had become absorbed, on the well-known principle, that an organ from want of use is often, especially in the lower animals, followed by its total disappearance. This vanishing, depauperation, and withering away of a foot now become useless, and as it were extinct from its complete inclosure, after it had performed its appointed duty of excavation, is in strict conformity with Lamarck's views (see page 158, last edition of the '*Animaux sans Vertèbres*'). Thus two most important facts are made evident by this phenomenon, which incontestably proves that the foot, agreeably to Mr. Hancock's views, is the excavator of the animal's dwelling ; and it stamps with additional consideration the Lamarckian doctrine of the progression and advancement of animality resulting from a want requiring to be supplied, which is effected by the concentration of the whole mass of vital energies, the circulation, nervous influences, aided by caloric, the gases, electricity, &c., in forcing and producing the supply of the particular want. That great philosopher instances the addition of tentacula to the *Helices* in explanation of his views ; and this doctrine is strongly corroborated, if the fact of the obliteration of the foot in *Pholadidea papyracea* is considered, *e contrario*, as a retrocession in animalization. This phenomenon also proves that nature never permanently retains what is superfluous, or refuses, as far as its power extends, to supply urgent requirements.

This important proof of the soundness of the laws promulgated by M. Lamarck, that nature mechanically produces the progressive march of animal improvement, almost makes us incline to assent to the high and metaphysical researches of that great naturalist, that the doctrine is not without foundation, that the first sparks of vitality arise from gravitation and molecular adherence, aided by the gases put in action by caloric, electricity, &c.* If we adopt this view, we admit that the germ of vitality communicated to matter arises from the mechanical power entrusted to nature ; but we must not for a moment forget that

* We would respectfully decline following our correspondent in these speculations.—R. T.

nature can do no more than perform the high behests of the Deity, nor exceed those limits of action confided to her by the Great Ruler of the universe, who is the *ens entium*, and the first cause of all that exists.

I revert to the boring Mollusca. Mr. Hancock has in many consecutive pages taken the pains to show, that mechanical boring, the solvents, and the ciliary currents, cannot be the causes of excavation. I shall not for a moment dwell on these agents, which are utterly worthless, and incapable of producing the effects attributed to them; but it may not be amiss to adduce some further observations corroborative of Mr. Hancock's position, that the foot is the true terebrating agent. As regards the *Pholades*, *Saxicavæ*, and the *Venerirupis perforans* of authors, they all inhabit the great littoral tracts of red sandstone on the Devon coasts, near Exmouth; this stone is composed of molecular grains so feebly conglomerated, that there is not the least necessity for the surface of the foot to be armed with siliceous points; the most gentle rubbing of that muscular coriaceous organ will amply suffice to hollow out the cubicula of the molluscan inhabitants of the red sandstone *on the Devon coasts*. The *Pholades* at Exmouth, and I believe elsewhere, are rarely or ever found in calcareous substances; the *Saxicavæ* are always in the sandstone; the *Modiolina gastrochæna* is never taken but in the coralline zone,—I speak of Exmouth,—and bores both stones and shells, as well as often forms its case of coarse agglutinated grains of sand or corally spoil. When the *Saxicavæ* and *Modiolina gastrochæna* are located in calcareous deposits, it is probable that nature in this case provides the foot or mantle with siliceous points; but I think the attrition of the foot, aided by fine simple sea-sand, is sufficient to rub down the cavities as fast as the animals grow. I corroborate by a thousand observations, that in the *Saxicavæ* and *Modiolina gastrochæna*, which have the foot slender and feeble, their mantles are strengthened by the most powerful muscular bands and fillets, which vary so much in shape, disposition and intensity, that I have in some cases used them successfully for specific distinction; and I have not the least doubt, as Mr. Hancock states, that this powerfully-armed ventral portion of the mantle of the closed boring Acephala is fully adequate to rub down their habitations. I believe that the foot or mantle of the entire class of Acephala has the power of terebrating, if circumstances require the exercise of it. It may be observed that many of the *Pholades* are not in all circumstances borers; many of them,—I may name the *Pholas dactylus* and *P. candida* at Exmouth, in the sandy districts,—pass their entire existence in pure sand; the same condition attaches to the *Venerirupis perforans* and many other bivalves. As to the borers

in wood, as the exotic *Pholas striata*, the *Teredines*, and *Xyl-phaga dorsalis*, the foot is the undoubted agent of perforation, and in this class is probably armed with rasping additions, and it cannot be doubted has the power to rub down the hardest oak faster than the animal can require; in fact, the harder wood, as oak, is more easily comminuted than the spongy deal or elm plank.

I take leave of this part of my present paper by again acknowledging the great service Mr. Hancock has conferred on malacological science, by definitively, as I think, determining the true functional causes of the terebrating powers in the Acephalous Mollusca.

I return to the question of the identity of the two forms of *Pholadidea papyracea*. I have already shown that the great variation in colour and markings between the adult *Pholadidea papyracea* and the young shell styled *Pholas lamellata* is the effect of generative influences, and that its conspicuous foot, when it arrives at full growth, which is testified by its becoming completely domed, is depauperated and finally obliterated. These two great and principal variations of aspect between the two forms of *Pholadidea papyracea*, resulting from states of transition, having I trust been satisfactorily disposed of, and every other part of the animal exhibiting a prototype similarity, it is impossible, as I think, to entertain further doubts of the positive identity of the two shells usually termed by authors *Pholas papyracea* and *P. lamellata*. I may add, that it has been asked in objection, how is it that twenty *Pholadidea papyracea* are taken for one *Pholas lamellata*, and that the two forms are not more frequently met with in the transition states? This objection quickly yields to a just view of the Pholades as regards habitat and other influences.

The Pholades are usually inhabitants of the littoral zone, but by no means always so, as some species also inhabit the more pelagic zones; the littoral shells are found in the superficial area of the red sandstone rocks from half-tide to the lowest littoral limits, and probably beyond, where they are unapproachable, at the depth of a very few inches; the whole area of the lower portion of the littoral zone is occupied by *pêle-mêle* colonies of *Pholas parva*, *Saxicava rugosa* and *Pholadidea papyracea*, generally of adult proportions, with an intermixture of a comparative paucity of the form *Pholas lamellata*. The *Pholas dactylus* and *P. candida* usually inhabit the higher levels of the littoral zone. The fact of the deficiency of the young of the *Pholadidea papyracea* is occasioned solely by the pre-occupation of the area of the sandstone rocks by the species I have mentioned, mostly adult; and when the genial season of reproduction arrives, the fry are ejected,

and vast numbers become, as I believe is the case with all the Mollusca, at least the majority, the prey of the Echinodermata, Crustacea and other enemies; therefore only a comparatively few survive, to continue the race and keep up the stock diminished by the annual demand for them, rarely for bait, but chiefly to supply the cabinets of the shell-collectors. These are the causes which fully account for the circumstance of twenty adult *Pholadidea papyracea* occurring for one in a state of adolescence; thus, in conformity with the Malthusian doctrine, the ground being pre-occupied, no more stock can be admitted until some of the older colonists are removed, and reproduction is consequently limited by the ova becoming the prey of a multitude of enemies.

I will say a few words on the pelagic *Pholades* inhabiting masses of stone dredged up in the littoral zones of the Devon coasts, six or eight miles from land. These shells, whether they are the two forms of *Pholadidea papyracea*, or the *Pholas parva* or *P. dactylus*, are always dwarf. I have a curious series of minute and completely adult *Pholadidea papyracea* not exceeding a quarter of an inch in length. Such shells are considered by the inexperienced observer as proofs that at all ages the *Pholadidea papyracea* is completely covered with a dome and continues gradually to increase: this is impossible, as when the dome and caliciform posterior extremity are once formed, all further growth is for ever terminated. The pelagic *Pholades* rarely exceed half an inch in length, consequently these dwarf forms are the result of locality, depth of water and many other conditions. In the deeper zones, the young forms of the present species, instead of being found in the proportion of one to twenty of the adult shells, appear in equal numbers: this discrepancy in the proportions of the young shells inhabiting the littoral and pelagic zones, must arise from the circumstance that in the deeper waters there is more room for reproduction, more sustentation and fewer enemies; this view corroborates the doctrine above, accounting for the disparity of numbers in the littoral zones between the young and old shells of this species. I have omitted to mention that I possess these shells in a genuine state of transition taken by myself *in situ*, and not produced by the arts of fraudulent dealers.

I terminate the present paper by stating a fact of the greatest importance in the œconomy of the Bivalves, which I believe is not generally known, and which was discovered by me twenty years since, but not then promulgated, except to a few friends, and lately I named it to Professor Forbes: though the fact was new then, I do not vouch that it is so now, as from my long secession from malacological pursuits, many of the recent discoveries,

scattered in the various works on natural history, may have escaped my attention.

All malacologists are acquainted with the existence of the hyaline cylindrical elastic stylet that is found in the bodies of all bivalves, whether great or small; I have seen this organ mentioned in a work on natural history that has escaped my memory, with the addition that its use is entirely unknown. Whilst dissecting the *Pholadidea papyracea* and other Pholades, in which this stylet is easily detected, and in which the larger end is imbedded in the muscular fundus of the body and foot, instead of drawing it forth as I had often done, I was induced to trace its course, and found that it terminated in the stomach, and had attached to it a light yellow doubled-up corneous subtriangular plate, wrinkled into three bluntly pointed lobes at one end, and at the other a membrane by which it is affixed to the elastic stylet. This discovery at once made evident the use of this appendage, and that it was an elastic spring to work the corneous plate or attritor, by the muscular action of the foot and body, to divide and comminute the food, and especially the minute crustaceous and testaceous alimentary matters received into the stomachal cavity; it appears then that this appendage acts as a gizzard, and the Bivalve Mollusca are thus supplied with a masticatory apparatus very analogous to the gizzards of some of the Gasteropoda.

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

III.—*Descriptions of Aphides*. By FRANCIS WALKER, F.L.S.

[Continued from vol. iv. p. 202.]

72. *Aphis Persicæ*, Sulzer, &c.

Aphis Persicæ has been described by several authors, but I believe that this name will apply to two species, and I defer giving the references until I can ascertain to which of these they most probably belong.

This *Aphis* feeds on the peach, *Amygdalus Persica*, in Europe and in North America, and on the sloe (*Prunus spinosa*); the latter tree is its original habitation, but the introduction of the peach into England caused a partial change in its nourishment. It sometimes passes from the peach to the cherry, and multiplies thereon. Schmidberger states that there are sixteen generations in one year, and that some of the young ones of the second generation acquire wings.

The viviparous wingless female. It appears on the buds of the peach-tree before the end of March, and when young is very

dark green, but when full-grown it is pale green, oval, convex, plump, and smooth, but not shining : the front is slightly convex, and not notched : the limbs are pale yellow ; the feelers towards their tips, the tip of the mouth, the feet, and the tips of the shanks and of the nectaries are brown : the feelers are rather less than half the length of the body ; the first and the second joints are not angular ; the fourth joint is much shorter than the third ; the fifth is shorter than the fourth ; the sixth is much shorter than the fifth ; the seventh is more than twice the length of the sixth ; the nectaries are about one-sixth or one-eighth of its length.

1st var. Pale green mottled with dark green.

2nd var. Pale yellowish green.

3rd var. Of a fine amber colour. Intermediate varieties also occur.

4th var., &c. In midsummer the masses on the young shoots are very thick, and the insect then has a great variety of tints ; its colour passes from pale red or green to the hue of a mellow peach, or to dark red, and sometimes the whole of the body is black : the legs are red ; the four hinder thighs except the base, the knees, the feet, and the tips of the shanks, are black.

5th var. Pale red, shining, reddish green beneath : the back, with the exception of a line along the middle and the borders of the segments, is red : the feelers are black, green at the base, and shorter than the body : the mouth is green ; its tip, the eyes and the nectaries are black, and the latter are one-twelfth of the length of the body : the legs are black : the fore-thighs, the base of the other thighs, and the shanks except their tips are yellow. On the cherry in July.

6th var. Bright red, with four or more indistinct rows of little black dots along the back : the head is dark red : the feelers are white, dark red at the base, black towards the tips, and rather more than half the length of the body : the mouth and the legs are dull white ; the tip of the mouth, the eyes, the nectaries, the hind-thighs except the base, the knees, the feet, and the tips of the shanks, are black. End of July.

In this form it is especially subject to the attacks of its enemies : *Trombidium holosericeum* devours it ; and an *Aphidius*, an *Allotria*, *Ceraphron Carpenteri*, and *Myina Chaonia* are its parasites.

7th var. The feelers are brown, pale yellow at the base ; the mouth is pale yellow with a brown tip : the nectaries are pale yellow with brown tips, and are one-sixth or one-eighth of the length of the body : the legs are pale yellow ; the feet and the tips of the shanks are brown.

8th var. The body is black, and other varieties occur when it

is more or less varied with red : there are no tubercles in front of the head.

The viviparous winged female. The pupa appears before the end of April, and the wings are unfolded in May. The insect is then black : the fore-chest and the abdomen are green ; the former has a broad black band across it, the disc of the latter is black, and there are rows of black spots on each side : the feelers are slender, and nearly or quite as long as the body ; the base of the third joint is pale yellow ; the fourth joint is very much shorter than the third ; the fifth is much shorter than the fourth ; the sixth is more than half the length of the fifth ; the seventh is nearly as long as the third, and thrice the length of the sixth : the mouth is pale green with a brown tip : the nectaries are black, and about one-sixth of the length of the body : the legs are pale yellow ; the feet, the tips of the thighs and of the shanks, and nearly the whole of the hind-thighs are black : the wings are colourless, and longer than the body ; the wing-ribs are pale green ; the wing-brands are pale brown, and the veins are darker ; the second vein diverges from the first, but is nearly parallel to the third ; the forks of the latter begin usually at one-third and at two-thirds of the length ; the fourth is slightly curved at its base, but nearly straight towards its tip ; the angle of the brands whence it springs is very slight.

1st var. The abdomen is dark reddish green, with a row of black spots on each side : the feelers are shorter than the body : the mouth is dark yellow ; its tip is black : the nectaries are as long as one-twelfth of the body : the thighs are black with the exception of the base : the wing-ribs and the rib-veins are pale yellow.

2nd var. The abdomen is black : the nectaries are about one-tenth of the length of the body : the mouth is red with a black tip : the shanks, with the exception of their tips and the fore-thighs towards the base, are also red : the wing-brands are dull buff. End of July.

3rd var. Dark brown : the abdomen is dull yellow ; the disc of its back and a row of spots on each side are black : the feelers are black, very slender, and a little longer than the body : the mouth is yellow ; its tip and the eyes are black : the nectaries are dull dark yellow, and as long as one-eighth of the body : the legs are black, slender, and rather long ; the thighs towards the base and the shanks with the exception of their tips are yellow. End of September.

In October this variety, which is of large size, occurs in abundance beneath the leaves, and is surrounded by flocks of bright green little ones, which as they continue to grow assume a bright pale red or yellow colour, and a variety of other tints.

4th var. The body is black: the abdomen is dark reddish green.

Variations of the wing-veins. 1st var.—There is no upper branch in the first fork of the third branch-vein, but the lower branch is subdivided.

2nd var. There is no second fork.

3rd var. The lower division of the second fork sends forth an additional branch which does not reach the border of the wing.

The oviparous wingless female. This appears in October, and is bright red and velvet-like, slightly oval, rather convex: the head is black: the disc of the abdomen is dark red: the feelers are black, white towards the base and as long as the body: the nectaries are white, with black tips: the legs are white; the tips of the thighs are pale brown; the feet and the tips of the shanks are black.

The winged male. The body is black: the abdomen is dark yellowish red, with a row of black spots on each side: the feelers are black, and as long as the body: the mouth is dull yellow, black towards the tip: the nectaries are pale yellow with black tips, and as long as one-fourth of the body: the thighs are black, pale yellow at the base; the shanks are dark reddish yellow, their tips and the feet are black: the wing-ribs and the rib-veins are pale yellow; the brands are pale brown; the veins are brown.

1st var. The abdomen is dark red.

2nd var. The disc of the abdomen is blackish.

3rd var. The abdomen is very dark green, almost black above: the feelers are longer than the body; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is less than half the length of the fifth; the seventh is longer than the fourth, and thick till near their tips: the base of the mouth is dull yellow: the nectaries are as long as one-sixth of the body: the thighs at the base and the shanks except their tips are yellow. It pairs with the oviparous female at the end of October and in the beginning of November.

Length of the body $\frac{3}{4}$ – $1\frac{1}{2}$ line; of the wings $2\frac{1}{2}$ – $4\frac{1}{2}$ lines.

The wingless and the winged females as usual appear alternately, and the peach-tree sometimes loses all its leaves from their ravages. *Formica nigra* is almost constantly attracted by it on the peach-tree; but when it swarms on the sloe in hedges, its original condition, large troops of *Formica rufa* come to feed on its honey.

73. *Aphis Rumicis*, Linn.

Aphis Rumicis, Linn. Syst. Nat. ii. 734. 5; Faun. Suec. 979; Fabr. Syst. Ins. ii. 385. 11; Syst. Ent. 735. 10; Ent. Syst. iv. 213. 12; Syst. Rhyn. 296. 12; Schrank, Faun. Boic. ii. 1. 111.

Ann. & Mag. N. Hist. Ser. 2. Vol. v.

1204; Gmel. ed. Syst. Nat. i. 2203; Stew. El. Nat. Hist. ii. 110; Kalt. Mon. Pfl. i. 81. 58.

A. Papaveris, Fabr. Gen. Ins. 303; Ent. Syst. iv. 218. 38; Syst. Rhyn. 299. 38; Gmel. ed. Syst. Nat. i. 2202; Schrank, Faun. Boic. ii. 1. 118. 1225; Rossi, Faun. Etrusc. 263. 1392; Leon Duf. Rech. sur les Hémipt. iv. 242. pl. 9. fig. 114, 115; Fonscol. Ann. Soc. Ent. x. 162.

A. Fabæ, Scop. Ent. Carn. 139. 408; Gmel. Syst. Nat. i. 2210; Kirby and Spence, Intr. Ent. i. 175; Bingley, Hist. Nat. iii. 189; Curt. Journ. Royal Agric. vol. vii. 418. pl. R. f. 21, 22, x. pt. 1. pl. U. f. 1-4.

A. Atriplicis, Fabr. Ent. Syst. iv. 216.

A. Aparines, Fabr. Syst. Ent. 735. 8; Sp. Ins. 385. 2? 9; Ent. Syst. iv. 211. 10; Syst. Rhyn. 291. 5? 10; Gmel. ed. Syst. Nat. i. 2208; Schrank, Faun. Boic. ii. 105. 1183.

A. armata, Hausm. Ill. Mag. i. 439. 30.

A. Craccæ, Linn. Syst. Nat. ii. 735. 13; Faun. Suec. 986; Fabr. Sp. Ins. ii. 390. 46; Deg. Ins. iii. 39. 5 or 8? pl. 2. fig. 14, 19; Scop. Ent. Carn. 407; Gmel. ed. Syst. Nat. i. 2205; Schrank, Faun. Boic. 111. 119; Kalt. Mon. Pfl. i. 86. 62.

A. Viciæ, Fabr. Sp. Ins. ii. 390. 46; Ent. Syst. iv. 220. 51; Syst. Rhyn. 301. 51.

A. Thlapseos, Schrank, Faun. Boic. ii. 118. 1227.

A. Galii? Kalt. Mon. Pfl. 87. 63.

A. Genistæ, Scop. Ent. Carn. 139. 409; Gmel. ed. Syst. Nat. i. 2210; Fons. Ann. Soc. Ent. x. 103; Kalt. Mon. Pfl. 90. 66.

A. Laburni, Kalt. Mon. Pfl. 85. 61.

A. Euphorbiæ? Kalt. Mon. Pfl. 94. 69.

Rumicifex, Amyot, Ann. Soc. Ent. 2^{me} série, v. 478.

Meconaphis, Amyot, Ann. Soc. Ent. 2^{me} série, v. 478.

Craccifex, Amyot, Ann. Soc. Ent. 2^{me} série, v. 478.

Genistifex, Amyot, Ann. Soc. Ent. 2^{me} série, v. 478.

A. Acetose, Linn. Syst. Nat. ii. 734. 6; Fabr. Syst. Ins. ii. 389. 43; Ent. Syst. iv. 220. 49; Syst. Rhyn. 301. 49; Geoff. Ins. 496. 9; Reaum. Ins. iii. 286; Gmel. ed. Syst. Nat. i. 2203.

A. Galii Scabri? Schrank, Faun. Boic. ii. 1. 105.

Cinara Rumicis, Sir Oswald Mosley, Gard. Chron. i. 747.

A. Dahliæ? Sir Oswald Mosley, Gard. Chron. i. 628.

The collier or black dolphin feeds on the following plants:—

Papaver Rhæas.

somniferum.

Hydrolapathum.

Rumex acutifolius.

obtusifolius.

Acetosa.

Rumex crispus.

conglomeratus.

Tragopogon pratense.

Serratula arvensis.

Centaurea Calcitrapa.

Euphorbia Paralias.

Arctium Lappa.	Chenopodium album.
Solanum.	Senecio vulgaris.
Scabiosa.	Arctium minus.
Inula dysenterica.	Valeriana officinalis.
Carduus lanceolatus.	Hypericum perforatum.
Eryngium campestre.	hirsutum.
Fumaria officinalis.	quadrangulare.
Cochlearia Armoracia.	Scorzonera.
Capsella bursa-pastoris.	Datura Stramonium.
Lycopersicum esculentum.	Cichorium Endivia.
Brassica Rapa.	Lactuca.
Erodium cicutarium.	Matricaria Chamomilla.
Lotus corniculatus.	Chrysanthemum segetum.
Faba vulgaris.	leucanthemum.
Pisum sativum.	Helichrysum chrysanthemum.
Phaseolus vulgaris.	Beta vulgaris.
coccineus.	Cytisus Laburnum.
Ononis.	Genista tinctoria.
Spinacia oleracea.	anglica.
Vicia.	Ulex europæus.
Mentha hirsuta.	Asparagus officinalis.
Cracca.	Sium latifolium.
Lamium purpureum.	Dahlia superflua.
Digitalis purpurea.	frustraria.
Cnicus arvensis.	Polygonum Persicaria.
palustris.	Myosotis scorpioides.
Anthriscus.	Solidago virgaurea.
Ægopodium.	Pastinaca sativa.
Æthusa.	Daucus Carota.
Galium Aparine.	Anagallis arvensis.
verum.	Angelica sylvestris.
Mollugo.	Verbena.
Achillæa Ptarmica.	Persicaria.
Nerium Oleander.	Urtica urens.
Atriplex hastata.	Viburnum Opulus, &c. &c.

The winged race migrate to the bean in May, and then bring forth their offspring, which at the end of June leave the withered flowers, and fix themselves along the sutures of the pods where their mouths can find an entrance.

The viviparous wingless female. When young it is linear, and dark red: the limbs are paler: when full-grown it is oval, convex, plump, and dull black, and has a row of punctures on each side: the feelers are white with black tips, and much shorter than the body; the fourth joint is much shorter than the third; the fifth is hardly shorter than the fourth; the sixth is about half the length of the fifth; the seventh is full as long as the third; the mouth is white with a black tip: the nectaries are as long as one-eighth of the body: the legs are white; the hind-thighs excepting the base, the knees, the feet, and the tips of the shanks, are black.

1st var. The body is dark green.

2nd var. The body is purplish black.

3rd var. The body is bronze black.

4th var. The body is shining.

5th var. The body is covered with a white bloom.

6th var. There are two stripes of white powder on the back.

7th var. The feelers and the mouth are black, dull white towards the base.

8th var. The feelers are nearly as long as the body.

9th var. The nectaries are as long as one-sixth of the body.

10th var. The nectaries are as long as one-twelfth of the body.

11th var. The tips only of the hind-thighs are black.

12th var. The legs are quite black.

13th var. Like the last, but the shanks and the fore-thighs are dull white.

14th var. The body is dull sooty black, oval, short, and plump : the front is convex, and has a tubercle on each side : the feelers are much shorter than the body ; the first and the second joints are not angular ; the fourth joint is much shorter than the third ; the fifth is shorter than the fourth ; the sixth is much shorter than the fifth ; the seventh is more than twice the length of the sixth.

15th var. The body is black, shining, and has a slight purple tint : the feelers are white, black at the base and towards the tips, shorter than the body : the eyes and the mouth are black ; the base of the latter is dull white : the nectaries are as long as one-sixth of the body : the legs are white ; the hind-thighs, excepting the base, the knees, the feet, and the tips of the shanks, are black.

16th var. The body is dull black : the feelers are white, blackish at the tips, and half the length of the body : the base of the mouth is dull white : the legs are white ; the feet and the tips of the shanks are black : when very young it is dark green with paler limbs.

17th var. The body is very dark green, of moderate size, sometimes nearly black : the feelers are dull white with black tips, and nearly as long as the body : the mouth is also dull white ; its tip and the eyes are black : the nectaries are black, and as long as one-fourth of the body : the legs are white : the knees, the feet, the tips of the shanks, of the hind-thighs, and sometimes also of the middle thighs, are black. On *Genista anglica* during the summer.

18th var. ? The body is oval, dull dark red, covered with a white bloom : the feelers are white with black tips, and hardly more than half the length of the body : the mouth is white ; its tip and the eyes are black : the nectaries are black, and as long as one-eighth of the body : the legs are yellowish white ; the

knees, the feet, and the tips of the shanks are black : it is smaller and narrower than the preceding variety, and its colour is less intense : when very young it is linear, and sometimes of a pale red or green colour : the pupa agrees in colour with the wingless *Aphis*, and has sometimes a green tinge. This, which may be a distinct species, also feeds on *Genista anglica*.

19th var. The body is black, oval, convex, plump, smooth, and shining, but often covered with a white bloom : the antennæ are white with black tips, and about half the length of the body ; sometimes they are black, dull white towards the base : the mouth is white, black towards the tip : the nectaries are as long as one-sixth of the body : there is a short tube at the tip of the abdomen : the fore- and the middle-legs are sometimes black, but more often white, with the exception of their knees, feet, and the tips of their shanks : the hind-legs are black with white shanks. On the furze in the autumn, often attended by *Formica nigra*.

20th var. Black, oval, convex, of moderate size : the feelers are pale green, and shorter than the body ; their tips are black : the mouth also is pale green ; its tip and the eyes are black : the nectaries are pale green, and rather less than one-sixth of the length of the body ; their tips are black : the legs are pale green, and moderately long ; the feet and the tips of the shanks are black. Its colour when young is dull dark green. On *Dahlia superflua* in the middle of June 1846.

21st var. Very dark green, sometimes almost black : the feelers and the mouth are dull white with black tips, and the former are nearly as long as the body : the eyes and the nectaries are black, and the latter are as long as one-fourth of the body : the legs are white ; the knees, the feet, and the tips of the shanks and of the hind-thighs, and sometimes also of the middle-thighs, are black. On *Genista anglica* in June.

22nd var. Velvet-like black : the feelers are white with a black tip to each joint, and a little shorter than the body : the nectaries are shorter than one-twelfth of the body : the legs are white with the exception of the knees, the feet, and the tips of the shanks. Middle of October.

23rd var. Deep black : the feelers are white, and more than half the length of the body ; they are brown at the base and towards the tips : the mouth is black : the nectaries are as long as one-tenth of the body : the legs are white ; the four hinder thighs excepting the base, the feet, and the tips of the shanks, are black.

24th var. The nectaries are as long as one-sixth of the body : the legs are black ; the shanks are yellow with black tips : the wing-ribs are white ; the wing-brands are pale brown ; the veins are brown ; sometimes it is covered with a white bloom, and its

feelers are gray towards the base and at the tips. When young the fore-part of the body is green; the limbs are white, but the feelers are sometimes pale green.

25th var. Small, black, shining, not very convex, with a slight green tinge, and having a row of punctures on each side of the body: the feelers are about half the length of the body: the mouth is dull green with a black tip: the nectaries are not one-twelfth of the length of the body: the legs are dull green.

26th var. Black: feelers black, shorter than the body, pale towards the base: the nectaries about one-eighth of the length of the body: legs yellow; four hinder thighs excepting the base, knees, feet and tips of shanks, black.

27th var. Body dull reddish green.

28th var. The body is dark green.

29th var. The body is small, black, slightly covered with a white bloom, increasing in breadth from the head till near the tip of the abdomen, which has a rim on each side: the feelers are shorter than the body: the nectaries are about one-eighth of its length. Found on *Galium Mollugo* in October near Newcastle by Mr. Hardy.

Length of the body $1-1\frac{1}{2}$ line; of the wings $2\frac{1}{2}-3\frac{1}{2}$ lines.

The viviparous winged female. While a pupa it has a row of white spots on each side of the abdomen, and its rudimentary wings are very dark green: the fore-border and the hind-border of the fore-chest are dark green: the abdomen is black, but its colour is not so intense as that of the chest, and sometimes it is slightly tinged with green: the feelers are black, and shorter than the body: the eyes are black and shining: the mouth is black; its base is dull green: the nectaries are black, and rather less than one-sixth of the length of the body: the legs are black, and moderately long; the shanks, and the fore-thighs except their tips are yellow: the wings are colourless, and much longer than the body; the wing-ribs are pale yellow; the wing-brands and the veins are pale brown; the second vein diverges from the third, but more from the first; the first fork of the third vein begins after one-third, and the second still more beyond two-thirds of the length; the fourth is curved moderately and equally throughout its length; the angle of the brand whence it springs is distinct. Much infested by *Leptus Aphidum*.

1st var. While a pupa it is pale dull olive-green, and covered with a white bloom; the wings are unfolded in the beginning of July, and the insect is then small, black, and shining: the abdomen is very dark green or black, and has a slight white bloom beneath: the feelers are black, and a little shorter than the body; the fourth joint is a little shorter than the third; the fifth is as long as the fourth; the sixth is much shorter than the fifth, but

more than half its length ; the seventh is longer than the fifth : the mouth is dark green ; its tip, the eyes and the nectaries are black, and the latter are nearly one-fifth of the length of the body : the legs are black ; the shanks except their tips, and sometimes the thighs of the fore-legs are dull yellow ; in the four hinder legs, the shanks except their tips, and sometimes the thighs from the middle to the base are pale yellow : the wings are colourless, and much longer than the body ; the wing-ribs are pale yellow ; the wing-brands are dull yellow or brown, and the veins are of the latter colour. It often frequents the mulberry in the autumn, and brings forth its young ones thereon.

2nd var. The body is black : the abdomen is very dark green : the feelers are black, and nearly as long as the body : the mouth is also very dark green with a black tip : the nectaries and the tube at the tip of the abdomen are black, and the former are as long as one-sixth of the body : the legs are black ; the base of the fore-thighs and the shanks except their tips are dark yellow : the wing-ribs are pale yellow ; the brands are pale brown ; the veins are brown.

3rd var. The body is black : the abdomen is dark green : the feelers are a little shorter than the body : the mouth is dull yellow with a black tip : the nectaries are black, and as long as one-sixth of the body : the legs are black ; the base of the fore-thighs and the shanks except their tips are dark yellow : the wing-ribs and the rib-veins are pale yellow ; the brands are pale brown ; the other veins are darker.

4th var. The body is black and very small : the feelers are a little shorter than the body : the nectaries are as long as one-eighth of the body : the wing-ribs and the rib-veins are yellow ; the brands are brown : the other characters like those of the preceding variety.

5th var. While a pupa it resembles in colour the 11th variety of the wingless Aphis, but the white parts are more dull : there is a row of white powder spots on each side of the body : the rudimentary wings are pale green.

6th var. The body is black and somewhat shining : the feelers are rather more than half the length of the body : the mouth does not reach the middle hips : the nectaries are about one-twelfth of the length of the body : the wings are longer than the body ; the wing-ribs are dull green ; the brands and the veins are brown.

7th var. While a pupa it is pale dull olive-green, covered with a white bloom, and its limbs agree in colour with those of the wingless female on the broom. When winged it is small, black, and shining : the abdomen is very dark green, or black, with a slight

white bloom beneath: the feelers are black, and a little shorter than the body; the fourth joint is a little shorter than the third; the fifth is as long as the fourth; the sixth is much shorter than the fifth, but more than half its length; the seventh is longer than the fifth: the mouth is dark green; its tip and the eyes are black: the nectaries and the legs are black; the former are nearly one-fifth of the length of the body; the shanks except their tips and the four hinder thighs from the base to the middle are yellow: the wings are much longer than the body; the wing-ribs are pale yellow; the brands are dull yellow; the veins are brown. On *Genista anglica* during the summer.

8th var. Like the preceding, but the fore-thighs and the fore-shanks are dull yellow with black tips; the four hinder shanks are pale yellow with black tips: the wing-brands are brown.

9th var. While a pupa it is gray: the abdomen is black, with three interrupted white bands, and has also four white spots near the tip: the rudimentary wings are dull green.

10th var. The body is small, and black: the feelers are longer than the body: the eyes are red: the nectaries are as long as one-sixth of the body: the legs are yellow; the thighs from the middle to the tips, the feet, and the tips of the shanks, are black: the wing-ribs and the rib-veins are pale yellow; the wing-brands and the other veins are pale brown.

11th var. The body is black, stout, and shining: the feelers are much shorter than the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are black, and about one-sixth of the length of the body: the legs are pale yellow; the hind-thighs except the base, the feet, and the tips of the other thighs and of the shanks, are brown: the wing-ribs and the brands are dull yellow; the veins are brown. On *Rumex crispus*. While a pupa the legs are black; the fore-thighs are yellow at the base: the rudimentary wings are dark green.

12th var. The four hinder thighs are quite black.

13th var. The body is deep black: the feelers are black, and shorter than the body: the eyes and the mouth are black; the base of the latter is dull white: the nectaries are black, and as long as one-eighth of the body: the four hinder thighs, the feet, the knees, and the tips of the shanks are black: the wing-ribs are pale yellow; the brands are pale green; the veins are pale brown.

14th var. With a row of white spots on each side of the back.

15th var. Like the last, but the feelers are much shorter than the body: the mouth is dark green at the base: the nectaries are as long as one-tenth of the body: the legs are black; the fore-thighs at the base, and the shanks excepting their tips are dull yellow: the wing-ribs and the brands are brown.

The oviparous wingless female. Found with the preceding, which it much resembles, but the hind-shanks are black, wide, and slightly curved. The eggs are laid in the beginning of October, and occur in abundance on the spikes of the furze.

The winged male. While a pupa it resembles the wingless *Aphis*: the feelers are rather more than half the length of the body: the nectaries are as long as one-tenth of the body: the legs are dull pale green; the feet and the tips of the thighs and of the shanks are black: the rudimentary wings are dull green. When the wings are unfolded it is black, and very small: the feelers are nearly as long as the body; the fourth joint is very nearly as long as the third; the fifth is as long as the fourth; the sixth is about half the length of the fifth; the seventh is longer than the fifth: the mouth is yellow with a black tip: the shanks except their tips, and the four anterior thighs at the base are yellow: the wing-ribs are yellow; the brands and the veins are brown.

74. *Aphis Symphyti*, Schrank.

Aphis Symphyti, Schrank, Faun. Boic. ii. 1. 107.

The viviparous wingless female. In August 1847 I found this species in great profusion under the leaves of the comfrey (*Symphytum officinale*) near Tottenham, but could see it nowhere else, notwithstanding the common occurrence of the plant. The grub of *Agromyza*?, of an orange colour and above one line in length, frequently devours it; an *Aphidius* and an *Allotria* are also among its enemies. It is a small species, oval, plump, bright yellow, with dark green nectaries; the head is often dark green, and sometimes this colour extends partly or wholly over the body, and is more or less mingled with yellow. It discolours the leaves of the comfrey, which are nevertheless adorned by its bright and many-coloured clusters. The forehead is convex in the middle, and has a slight tubercle on each side at the base of the feelers: the mouth reaches the middle hips: the feelers are setaceous, and shorter than the body; the fourth joint is shorter than the third; the fifth is a little shorter than the fourth; the sixth is a little more than half the length of the fifth; the seventh is more than twice the length of the sixth: the fore-chest has a suture across the middle; its sides are slightly convex: the nectaries vary in length from one-sixth to one-twelfth of the length of the body, and in some cases where they are shortest, the legs also are very short, and the feelers are much less than half the length of the body: the fore-legs are but little shorter than the hind-legs; the shanks are straight.

1st var. The body is dark green, with a white bloom, and mottled with paler green: the feelers are yellow with brown tips,

and a little shorter than the body : the eyes are black : the mouth is pale yellow with a black tip : the nectaries are black, and nearly as long as one-fourth of the length of the body : the tube at the tip of the abdomen is pale green : the legs are yellow, and moderately long ; the feet and the tips of the shanks are brown.

2nd var. The body like the last, but with a metallic lustre.

The viviparous winged female. This, as usual, has a dark colour on the chest, the breast, and some parts of the abdomen. Soon after the middle of the fore-border of the wing its main vein begins to widen rather abruptly into an irregularly spindle-shaped brand : the fourth vein springs from a hardly perceptible angle of this brand, and is moderately curved ; the third vein is obsolete at its source ; it is forked after one-third of its length, and forked again long after two-thirds of its length : in some instances the lower branch and in others the upper branch of the second fork are wanting ; the first vein diverges from the second more than the second diverges from the third. It sometimes contains ten young ones, all of the same size.

1st var. While a pupa it resembles the wingless insect, but the body is elliptical, the feelers and the legs are darker, the rudimentary wings are pale green. The winged *Aphis* is black : the borders of the fore-chest are green : the abdomen is dark green : the feelers are black, and shorter than the body : the mouth is black, dark green at the base : the nectaries are black, and as long as one-sixth of the body : the legs are black, and moderately long ; the fore-thighs are yellow at the base : the wings are colourless, and very much longer than the body ; the wing-ribs are pale yellow ; the brands and the veins are brown. Length of the body $\frac{1}{2}$ – $\frac{3}{4}$ line ; of the wings $1\frac{3}{4}$ – $2\frac{1}{4}$ lines.

75. *Aphis Nymphææ*, Linn.

Aphis Nymphææ, Linn. Syst. Nat. ii. 714. 10 ; Faun. Suec. 983 ; Fabr. Ent. Syst. iv. 214. 18 ; Syst. Rhyn. 297. 18 ; Schrank, Faun. Boic. ii. 1. 117. 1224 ; Gmel. ed. Syst. Nat. i. 2204 ; Müller, Ins. 1264 ; Turt. ii. 703 ; Kalt. Mon. Pfl. i. 104. 79 ; Fonscol. Ann. Soc. Ent. Fr. x.

A. Butomi, Schrank, Faun. Boic. ii. 114. 1212.

Nymphæifex, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 478.

This species feeds on the following water-plants : *Nymphæa alba*, *N. lutea*, *Alisma Plantago*, *Butomus umbellatus*, *Potamogeton natans*, *Sagittaria sagittifolia*, *Utricularia vulgaris*, *Hydrocotyle vulgaris*, *Fontederia cordata*, and some other species. It has an unfailing supply of moist and nourishing food, and accordingly seems to multiply more abundantly than any other species.

The viviparous wingless female. Deep olive-green, shining, and

having a metallic tint : the front has a tubercle in the middle and a smaller one on each side : the feelers are black, very often pale green at the base, and much shorter than the body ; the first and the second veins are not angular ; the fourth is much shorter than the third ; the fifth is a little shorter than the fourth ; the sixth is much shorter than the fifth ; the seventh is about thrice the length of the sixth : the mouth is dull green ; its tip and the eyes are black : there is a red spot, sometimes obsolete, on each side of the abdomen by the nectaries which are reddish yellow with black tips, and about one-sixth of the length of the body : the legs are black, moderately long, and slightly covered with a white bloom. The young one is comparatively pale, narrow, flat, and linear.

1st var. Reddish green, mottled with black.

2nd var. Nearly black.

The viviparous winged female. This much resembles the preceding form, with the exception of its darker colour, and of the usual difference in structure : the wings are colourless, and much longer than the body ; the first vein hardly diverges more from the second than the latter does from the third ; the third vein has its first fork after one-third, and its second still further beyond two-thirds of its length ; the fourth vein is more curved at its base than towards its tip, and the angle whence it springs is very slight. Length of the body 1 line ; of the wings 3 lines.

Variation in the wing-veins. The upper division of the second fork is wanting.

The glutinous matter which covers this species assumes, like that of *Aphis Roboris*, a fine red colour when mixed with Canada balsam.

76. *Aphis Sambuci*, Linn.

Aphis Sambuci, Linn. Syst. Nat. ii. 734. 4 ; Faun. Suec. 998 ; Fabr. Syst. Ins. ii. 384. 3 ; Ent. Syst. iv. 211. 4 ; Syst. Rhyn. 294. 4 ; Lister, Ins. 397. 40 ; Geoff. Ins. i. 495. 3 ; Frisch. Ins. ii. 14. pl. 18 ; Réaum. Ins. iii. 281–350. pl. 21. fig. 5–15 ; Gmel. ed. Syst. Nat. i. 2202 ; Bonnet, Hist. Nat. i. ; Berk. Syn. i. 110 ; Stew. El. ii. 110 ; Turt. ii. 703 ; Schrank, Faun. Boic. ii. 1. 111. 1202 ; Kalt. Mon. Pfl. i. 83. 60.

Cinara Sambuci, Sir Oswald Mosley, Gard. Chron. i. 827.

Sambucifex, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 477.

The viviparous wingless female. This is oval, dull, very plump, and of a deep green colour : the sutures of the segments beneath are more distinct than those above : the feelers are slender, setaceous, almost white, and about one-third of the length of the body : the mouth is pale green : the eyes are dark brown : the nectaries are dark green, and about one-twelfth of the length of

the body : the legs are dull pale green, slender, and rather short ; the knees are somewhat darker. On the leaves of the elder in the middle of March 1846.

1st var. Extremely dark green, apparently black, covered with a white bloom, and having a row of punctures on each side of the body : the front is slightly convex, and not notched : the feelers are black, and rather more than half the length of the body ; the first and the second joints are not angular ; the fourth joint is much shorter than the third ; the fifth is a little shorter than the fourth ; the sixth is much shorter than the fifth ; the seventh is much more slender than the sixth, and nearly twice its length : the eyes are also black : the mouth is very dark green : the nectaries are black, and about one-eighth of the length of the body, and slightly tapering : the legs are very dark green, and moderately long. When young it is green, linear, and somewhat narrow and flat. In thick swarms on the shoots of the elder, which are sometimes quite hidden by the clusters, from the end of May to July.

2nd var. Like the preceding, but with a reddish tinge.

3rd var. The body is green.

4th var. The nectaries are about one-sixth of the length of the body.

The viviparous winged female. While a pupa it is elliptical, rather paler and more flat than the wingless female, and it has interrupted white bands across the abdomen : the chest and the rudiments of the wings are green, and they have sometimes a reddish tinge. When winged the body is rather large, black, shining, nearly linear : the feelers are black, stout and thick, and more than half the length of the body ; the fourth joint is much shorter than the third ; the fifth is full as long as the fourth ; the sixth is rather more than half the length of the fifth ; the seventh is longer than the sixth : the abdomen beneath and the mouth are very dark green : the nectaries are black, and about one-sixth of the length of the body : the legs are black ; the fore-thighs are dark green at the base : the wings are slightly gray, and not much longer than the body ; the wing-ribs are yellowish white ; the brands are pale brown ; the veins are black, strongly marked, and very slightly clouded ; the first vein diverges more from the second than the second from the third ; the latter is obsolete at its source, and its first fork is after one-third, and its second still more after two-thirds of its length ; the fourth vein is moderately curved at its base, nearly straight towards its tip, and the angle whence it springs is very slight. Length of the body $1-1\frac{1}{2}$ line ; of the wings $2\frac{3}{4}-3\frac{1}{2}$ lines.

[To be continued.]

IV.—*Contributions to the Botany of South America.*

By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from vol. iv. p. 363.]

SALPIGLOSSIS.

UPON a former occasion (*huj. op.* iii. p. 172) many reasons were adduced to show why the tribe of the *Salpiglossideæ*, as constituted by Mr. Bentham (DC. Prodr. x. 190), could not be maintained, and I proposed to limit that tribe simply to *Salpiglossis*, *Browallia*, *Leptoglossis*, and a new genus *Pteroglossis*, all being distinguished by their singularly dilated stigma and the peculiar mode of æstivation of the corolla. A careful examination of *Leptoglossis schwenckiioides* has since then offered reasons for placing that genus among the *Petunieæ*. The *Salpiglossideæ*, however, as thus limited, are evidently most intimately allied to the *Petunieæ*, agreeing with them in a somewhat similar form of stigma, the development of their stamens, their capsular fruit, and the very spiral form of the embryo in *Salpiglossis*, and differing from them only in their didynamous stamens and the æstivation of the corolla. The didynamous arrangement of the stamens does not appear to me to offer a sufficient reason for keeping them in an ordinal point of view apart from the *Petunieæ*, and for retaining them in the *Scrophulariaceæ*; indeed in the *Petunieæ* and *Nicotianeæ*, we find an evident tendency towards a didynamous structure, for one of the stamens is constantly shorter than the others, which are in two pairs, while the anther of the fifth is always somewhat smaller, and frequently almost sterile; and on the other hand, I have observed occasionally in *Salpiglossis* a fifth fertile stamen, showing a disposition to return to its normal condition; and I have also before me an instance of a flower with three pairs of stamens, varying in length, with a seventh shorter one, the anther of which, though smaller than the others, is fertile. The position of the *Salpiglossideæ* in the natural system appears to me therefore manifestly in the family which I propose to call *Atropaceæ*, or if considered only as a suborder, *Atropineæ*, according to the arrangement there shown (*loc. cit.* p. 165).

There is little in the genus *Salpiglossis* that calls for observation; one peculiar feature however claims attention, the singular form of its pollen-grains: these are comparatively large and readily distinguished under a common lens, each granule consisting of four agglutinated spherical globules similar in form to the simple pollen-grains of most *Solanaceæ* and *Scrophulariaceæ*: three of these globules are on the same plane, the other being superimposed in the centre, thus forming a sort of rounded tetrahedron, and they adhere so completely that they cannot be sepa-

rated without bursting. The fact is noticed by Mr. Hassall in his memoir "On the Structure of Pollen" (Ann. Nat. Hist. viii. 100), who states that so curious a circumstance is not singular, as it occurs in *Oxyanthus* in *Cinchonaceæ*, *Leschenaultia* in *Goodeaniaceæ*, and in some species only of *Epilobium* in *Onagraceæ*: the same is also observable in all the genera of the *Epacrideæ* and of *Ericaceæ*, with the exception of *Clethra*, where they are simple. From these analogous facts it is evident that this compound structure of the pollen-grains is not of sufficient importance to affect in any way the ordinal position of *Salpiglossis*.

Mr. Bentham mentions only a single species of this genus, as he considers all our garden kinds as mere varieties of *S. sinuata*. On this head I may remark, that I found in Chile, plants which I always considered to be two very distinct species, viz. *S. sinuata* (my *S. glutinosa*) and my *S. purpurea* (Trav. ii. p. 531); but I have little doubt that *S. picta*, *S. Barclayana*, *S. fulva*, *S. intermedia*, &c. are all hybrid productions from these two species. I always met with *S. sinuata* growing near the coast, its corolla being constantly of a yellowish white, with brownish stripes; on the contrary, I invariably found *S. purpurea* at a much greater elevation near the foot of the main Cordillera, or within its gorges, its flowers being always of a dark lilac, with deep purple lines, and never of the yellowish hue so conspicuous in *S. sinuata*. I cannot however refer to my original specimens, as they were unfortunately lost off Cape Horn with my general Chile collections; but the coloured drawings of both species made in 1820, and which I have preserved, serve to impress these facts strongly on my memory. From the several dried specimens of *Salpiglossis* in Sir William Hooker's herbarium collected by Gillies, Cuming and Bridges, we may detect at a glance the two different species. The following I consider as the amended diagnosis of this genus:—

SALPIGLOSSIS, R. & P. (char. emend.).—*Calyx* tubulosus, 10-nervis, 5-dentatus, dentibus subæqualibus, attenuatis, obtusiusculis. *Corolla* infundibuliformis, tubo imo cylindraceo, superne campanulata, compressa, limbo 5-lobo, obliquo, subbilabiato, lobis profunde emarginatis, superiore majore, erectiore, æstivatione reciprocativa*. *Stamina* 5, inclusa, quorum 4 didynama, quinto breviori, sterili; *filamenta* subulata, e constrictione tubi orta; *antheræ* ovatæ, 2-lobæ, basi cordatæ, subversatiles, lobis adnatis, rima marginali dehiscens; *pollen* compositum, e granulis 4 aggregatis, quorum 1 superpositum. *Ovarium* conicum, disco carnosio sub-2-lobo impositum, 2-loculare; *placentæ* centrales, dissepimento utrinque adnatæ, multi-

* Ann. Nat. Hist. 2nd Ser. vol. iii. p. 172.

ovulatae. *Stylus* exsertus, apice compressus, incrassatus, subincurvus. *Stigma* majusculum, transverse dilatatum, semilunare, bilabiato-emarginatum. *Capsula* oblonga, calyce persistente tecta, 2-locularis, septicido-2-valvis, valvis chartaceo-coriaceis, 2-fidis, placenta centrali demum solutis. *Semina* plurima, minuta, subangulata, hilo laterali; testa striato-rugosa. *Embryo* intra albumen carnosum spiraliter curvatus, teres, *radicula* arcuata, ad angulum basalem spectante, *cotyledonibus* 4-plo longiore.—Herbæ *Chilenses glanduloso-pubescentes*; folia alterna, lanceolata, inferioribus sinuato-laciniatis, petiolatis, superioribus linearibus, sessilibus, sinuatis, floriferis linearibus, subbracteiformibus. Inflorescentia paniculata, floribus pedicellatis, pedicellis extra-axillaribus; corolla straminea vel purpurea, lineis anastomosantibus picta.

1. *Salpiglossis sinuata*, R. & P. Syst. Veg. 163; Prodr. tab. 19. S. glutinosa, Miers, Trav. ii. 531. S. straminea, Hook. Exot. Fl. p. 229. S. picta, Sweet, Br. Fl. Gard. tab. 258; Hook. Bot. Mag. tab. 3365;—omnino viscoso-pubescent, foliis inferioribus laxis, lanceolatis, acute pinnatifido-incisis, superioribus breviter petiolatis, inciso-dentatis, laciniis acutis, floralibus sessilibus, linearibus, integris, bracteiformibus; corolla lineis violaceis picta, tubo lutescente, limbo stramineo.—Chile, ora littorali, in herb. Hook. (Gillies, Mathews, Cuming, Bridges).

This plant, well known in our gardens, grows to the height of 2 or 3 feet. Its leaves are of more delicate texture, always longer, narrower, and more deeply incised into acute segments than in the following species: they are 5 inches long, including the petiole, on which they are decurrent, and $1\frac{1}{4}$ inch broad, or 7 lines across at the base of the incisures. I observe a note upon my drawings, stating that in this species, the two lower stamens, between which the sterile one is situated, form the longest pair, while in *S. purpurea* the same stamens form the shorter pair, and I have found this in the dried specimens I have examined, but I cannot at this distance of time assert it to be a fact of constant occurrence.

2. *Salpiglossis purpurea*, Miers, Trav. ii. p. 531;—viscoso-pubescent, foliis radicalibus confertis, elliptico-oblongis, apice obtusiusculis, imo in petiolum elongatum cuneatis, margine grosse et obtuse dentatis, crassis, caulinis integrioribus, lanceolatis, obtusis, petiolo abbreviato, floralibus linearibus, sessilibus, bracteiformibus; corolla tubo purpureo, limbo violaceo, reticulatim picta.—In Andibus Chilensibus, v. s. in herb. Hook., Gillies (S. andicola, MSS.).

Var. β . *atropurpurea*, Graham. Corolla reticulatim nigro-picta, limbo profunde purpureo. Cuming.

This plant seldom exceeds a height of 15 or 18 inches : it has a stronger and more woody stem, and may easily be distinguished from the former species by its radical leaves, which are of thicker texture, broader in proportion, shorter and more elliptic, with short obtuse teeth, and not deeply divided with acute incisures, as in *S. picta*: the radical leaves, including the attenuated petiole, are $3\frac{1}{4}$ inches in length, the limb being $2\frac{1}{2}$ inches long and 11 lines broad.

PTEROGLOSSIS.

Among the very curious and interesting plants collected by Bridges in the vicinity of Coquimbo, is one that will constitute a new genus, near *Salpiglossis*. It is a plant with pinnatifid leaves, only in a few of the lower axils, those above being reduced to a linear form; its ascending stems are widely diffuse in many spreading dichotomous branchlets, which are very slender and terete; the leaves at each axil are gradually diminished to the size of very short linear bracts, which support a few solitary one-flowered peduncles. The corolla, though smaller, has much the shape of that of *Salpiglossis*, with didynamous included stamens, and it possesses the peculiar æstivation of the *Salpiglossideæ*. The most remarkable feature consists in the unusually broad expansion of its stigma, which hoods the lower pair of stamens, somewhat after the manner of *Nierembergia*, its winged appendages being quite membranaceous, decurrent for some length upon the style, and marked with numerous parallel radiating nervures, which terminate in its lacerated or crenulate margins. The name above proposed is derived from *πτερόν*, *ala*, and *γλῶσσα*, *lingua*, because of its broadly winged stigma.

PTEROGLOSSIS (gen. nov.).—*Calyx* tubulosus, subcylindricus, breviter 5-dentatus, 10-nervis, dentibus acutis. *Corolla* infundibuliformis, tubo imo coarctato, hinc ventricosus, 15-striatus, limbo expanso, inæqualiter 5-lobo, sub-bilabiato, lobis omnibus emarginatis, superiori longiori et latiori, æstivatione reciprocativa*. *Stamina* 4, didynama, inclusa, postica longiora; *filamenta* dilatata, apice angustata. *Antheræ* ovatæ, 2-lobæ, imo divaricatæ, apice sine connectivo in sinu apicifixæ, rima marginali dehiscentes. *Ovarium* disco carnosus sub 2-lobo impositus, stipitatus, 2-locularis, placentis centralibus dissepimento adnatis, multiovulatis. *Stylus* apice dilatatus, inflexus. *Stigma* bialatum, emarginatum, superne carinatum, infra planum, glandula viscoso in sinu notatum, alis latis, membranaceis, in stylum longe decurrentibus, radiatim nervosis, margine sublaceratis, staminibus inferioribus amplecten-

* Ann. Nat. Hist. 2nd Ser. iii. p. 172.

tibus. *Capsula* calyce persistente tecta, 2-locularis, 2-valvis, valvis semibifidis, placenta centrali demum solutis. *Semina* ignota.—*Planta Chilensis subglabra*, radice lignosa perenni, caulibus plurimis adscendentibus, gracilibus, laxis, divaricatis ramosis; folia alterna, inferioribus sinuato-pinnatifidis; pedunculi uniflori, axillares, paniculam laxam efformantes.

1. *Pteroglossis laxa*;—subglabra, ramosissima, ramis plurimis, teretibus, gracilibus, laxe divaricatis, nodis distantibus; foliis axillaribus, inferioribus oblongis, sinuato-pinnatifidis, in petiolum spathulatis, sub lente minutissime pubescentibus, mediis linearibus, supremis floriferis in bracteis parvis decrescentibus: pedunculis solitariis, viscoso-pubescentibus, unifloris; floribus parvulis; corolla straminea, lineis violaceis picta.—Coquimbo, in herb. Hook. (*Bridges*, no. 1839).

This plant has very much the habit of *Schwenkia americana*: the root is ligneous, as well as a short perennial woody stump, from which arise several somewhat erect branches 12 to 18 inches long, which are evidently deciduous; these are slender, terete, glabrous, flexuately brachiate at each axil, and again dichotomously branched: below, the axils are more approximate, above widely distant. The lower leaves are sinuato-pinnatifid, about 1 to $1\frac{1}{4}$ inch long including the petiole, and 3 lines broad including the segments; to the naked eye they appear quite smooth, but under the lens they are seen to be invested by numerous, very short, minute hairs: these leaves gradually diminish to the size of $\frac{3}{4}$ to 1 inch long and only half a line broad, and as they ascend they become smaller, till they arrive at the terminal floriferous branchlets, where they assume the form of linear bracts, scarcely a line in length and $\frac{1}{8}$ th of a line broad; from each of these springs a very slender glandular pubescent peduncle, about half an inch in length, bearing a solitary flower; the calyx is $1\frac{1}{2}$ line long, tubular, and crowned by five equal fleshy erect teeth; the corolla is about 4 lines long, of a yellowish colour, marked by about fifteen violet-coloured, parallel, branching lines; the tube is contracted and cylindrical below for one-third of its length, above this it is ventricose, with a border of five, oblong, rounded and emarginate patent lobes, the upper one of which is somewhat longer and broader; they assume in æstivation that peculiar mode of plication which I have called reciprocative (*loc. cit.* 172); the didynamous stamens are included, arising from the contracted portion of the tube; the ovarium is oblong, 2-grooved, imbedded in a fleshy 2-lobed cup borne upon a short stipitate support, and surrounded by the individual remains of the corolla; the style is slender, the length of the stamens, inflexed at its apex, and gradually widening consi-

derably by the broad decurrent wings of the stigma, which hood the anthers of the somewhat shorter pair of stamens: the stigma is broad, membranaceous, deeply emarginate at its apex, constituting two distinct rounded wings, marked by numerous radiating nervures; it forms altogether a galeate head, flattened on the under side and keeled on the upper surface by the prominent sharp margin of the style, which carinated edge is terminated in the sinus by a viscous globular gland. The capsule is small, consisting of two bifid valves, parallel to the dissepiment, and inclosed by the persistent calyx. I had no opportunity of examining its seeds*.

LEPTOGLOSSIS.

This genus was founded by Mr. Bentham, in the 'Botany' of the Voyage of the Sulphur, for a Peruvian plant, which has not yet been figured, nor have the details of its structure been hitherto delineated or minutely examined. It possesses much the habit of a *Browallia*, to which it offers some resemblance in the form of its corolla; but it differs from that genus in having a fifth sterile stamen and in the shape of its stigma, which is intermediate between that of *Pteroglossis* and of *Salpiglossis* or *Nierembergia*. No opportunity had presented itself for examining the æstivation of the corolla of *Leptoglossis* when I offered the remarks upon the tribe of the *Salpiglossideæ* (Ann. Nat. Hist. 2nd Ser. iii. 173); but recent observation has enabled me to state that it is decidedly imbricative, and as far as can be judged from well-macerated dried specimens, it is apparently of that modification which I have called replicative (*loc. cit.* 173), the postical lobe being altogether interior, as in *Nierembergia* and *Petunia*. The alliance of *Leptoglossis* is clearly with the two latter genera, agreeing with the former in its small lanceolate leaves, its calyx, its slender tubular corolla, in the dilatation of its stigma, in the long stipitate support of the ovarium, in its persistent hypogynous glands, and in its stipitate capsule. With the latter genus it agrees in the obliquity of the border of its corolla, and the somewhat palate-like enlargement of the tube below the throat. The position of *Leptoglossis* is manifestly among the *Petunieæ*, and not in the *Salpiglossideæ*, as suggested in the tabular arrangement (*loc. cit.* p. 165). It appears to me to hold no relation whatever to *Schwenkia*.

The following generic character has been made, after a careful analysis of the plant referred to:—

LEPTOGLOSSIS, Bth. non D.C. Char. emend.—*Calyx* brevis, tubulosus, nervis 15 in seriebus 5 ternariis pressius ordinatis,

* This plant, with its analytical details, will be shown in plate 52 of the 'Illustr. South Amer. Plants.'

interstitiis eveniis membranaceis, 5-anguloso-sulcatus, 5-dentatus, dentibus acutis linearibus callo-mucronatis. *Corolla* tubularis, elongatus, tubo imo carnosulo 5-sulcato constricta, medio subcylindrica, in faucem antice breviter ventricosa, limbo obliquo, 5-lobo, lobis suborbicularibus, 2 anticis minoribus reflexis, postico erectiusculo, æstivatione imbricata, verisimiliter replicativa. *Stamina* 5, inæqualia, inclusa, quorum 4 didynama, cum quinto sterili; *filamenta* subdilatata, tenuissima, posteriorum e coarctatione tubi orta, anteriorum dimidio breviora medio corollæ inserta, sterili sub-breviore intermedio; *antheræ* in faucem conniventes, stigmatate deflexo circumplexæ, 2-lobæ, in sinu apicifixæ, lobis basi divaricatis, apice sine connectivo connatis, et rima marginali bivalvatim transverse hiantibus; posteriorum dimidio minore; sterili oblonga, cassa, erecta. *Pollen* simplex, globosum, 3-sulcatum. *Ovarium* oblongum, conicum, longiuscule stipitatum, glandulis 5, carnosiss, coloratis, subliberis, rotundatis, summo stipitis connatis, et discum hypogynum cupuliformem persistentem fingentibus, 2-loculare, placentis centralibus, multiovulatis, dissepimento utrinque adnatis. *Stylus* tenuis, inclusus, apice incurvatus, compressus, valde dilatatus. *Stigma* emarginato-2-labiatum, lobis latissimis, brevibus, truncatis, intus incrassatis et viscoso-glandulosis, inferne longe auriculatis et membranaceis, antheras amplectentibus. *Capsula* calyce persistente tecta, 2-locularis, septicide 2-valvis, valvis semibifidis, placenta centrali demum solutis. *Semina* plurima, parva, reticulato-favosa; cetera ignota.—Herba *Peruviana viscoso-pubescent*; folia *alterna, parva, sessilia, lanceolata, integra*; cymæ *plurimæ, alternæ, terminales, ex axillis foliorum superiorum lateraliter ortæ, longe et patentim pedunculatæ*; flores *parvuli, pedicellati, conferti*; corolla *albida*.

1. *Leptoglossis Schwenkioides*, Bth. Voy. Sulph. 143;—undique viscoso-pubescent; foliis lineari-lanceolatis, acutis, 1-nerviis, apice callosis, sessilibus, in turionibus sæpe fasciculatis, superioribus decrescentibus; corolla tenui, glabra, intus imo retrorsim pilosa.—Peruvia, v. s. in herb. Hook. (Huamantango, Barclay; Peru, Mathews, no. 1011; Cuming, no. 1010).

This plant has very much the habit of some of the small-leaved species of *Petunia*; its branches are virgate, the leaves 6 to 9 lines long, 1 to $1\frac{1}{2}$ line broad; the floral branchlets are about 1 inch long, generally with three to five flowers at the extremity of each; the pedicels are very short; the calyx 2 lines in flower, 3 lines in fruit; the tube of the corolla is 8–9 lines in length, 1 line broad, the border 3–4 lines in diameter; the capsule is 2 lines long*.

* A figure of this species, with sectional details, will be given in plate 53 of the 'Illustr. South Amer. Plants.'

V.—*Observations on the Structure of the Orchidaceæ, particularly the Vanædæ.* By Prof. H. F. LINK*.

LINDLEY, who has contributed so much to the knowledge of the Orchidaceæ, gives them the following character in his 'Vegetable Kingdom.' He ascribes to them a trifoliate calyx, a trifoliate corolla, the third segment of which, the labellum, is of very different form from the other two; further, three stamens, of which either the two outermost are abortive, and only the intermediate one bears an anther, or the intermediate one is abortive, and the two outer bear anthers; finally, three divisions of the stigma. In reference to the stamens and the stigma he wholly follows R. Brown. But he directs attention to an anomaly, relating to the stigma, which consists in the fact that the seminiferous portions of the ovary are not opposite to the lobes of the stigma, but alternate with them, as the seedless portions occur in a line with the lobes; so that we ought therefore to say that the ovary consists of six carpellary leaves.

R. Brown came to the idea that the Orchidaceæ have properly three stamens, from the circumstance that there occurs very frequently, especially in the New Holland Orchidaceæ, on each side of the anther-bearing column, an appendix which represents those stamens. He observes indeed, that those appendices also occur when, from a higher degree of development, three stamens are present, for we have examples of this; and he does not conceal that these appendices are devoid of vessels, but he adds that he does not consider the presence of these as determining an organ. It appears to me however, in opposition to the opinion of this celebrated observer, that the presence of such vessels is indispensably necessary to the determination of an organ. For in all the organs of the Phanerogamia the vascular bundles (of spiral or pseudo-porous vessels, or both together) form the foundation of the organ, nay, even determine its form, and there is no organ of any importance without them. In the Naiadeæ, and if instead of Phanerogamia we use the more definite word Phanerophytes, in the Mosses, tubes or elongated cells occur instead of them in the interior of the organ. From this it follows that they are the sap-bringing vessels. It is requisite to know therefore what is the condition of the vascular bundles in the column of the Orchidacean flower, when stamens and style are united.

Before we enter upon this inquiry, the following remarks are necessary. All botanists, except Linnæus, make the labellum a division or leaflet of the perigone and of its inner circle, which

* Extract from a Treatise read before the Berlin Academy of Sciences; translated from the 'Botanische Zeitung,' by Arthur Henfrey, F.L.S.

Lindley calls the corolla. Yet the labellum never stands in a circle with the two leaflets of this corolla, but always with the column (*columna, gymnostemium*), in which stamens and style are blended together; indeed in most cases it is itself confluent with this. Lindley himself mentions this, and adds, that in some species of the Cape genus *Pterygodium* the labellum proceeds from the apex of the column. If in these cases we should assume an external adherence of the labellum to the column, which however in some, especially in *Scaphyglottis*, could not be supposed, on account of the insensible transition, then the base of it ought to stand in a circle with the leaflets of the corolla, which never happens. Even in the cases where the labellum appears quite separate from the column, in *Cattleya*, many *Maxillariæ*, and also in our indigenous species of Orchidaceæ, there is always a confluence of the base with the column, above the leaflets of the corolla. It does not admit of doubt, that the prevalence of the number three in the class of Monocotyledons gave rise to the idea that the labellum belongs to the corolla. But facts are preferable to opinions.

Moreover if we examine the upper side of the column in the indigenous Orchidaceæ, *e. g.* in *Orchis* itself, we see a part, broad below and running up into a point above, embracing the two anther-cells. This is evidently a connecticulum; that is, the upper expanded part of the stamen, which bears the two chambers of the anther. If we make a transverse section, first through the upper part of the column, where the excavation of the stigma is still shallow, we see a large vascular bundle on the outer side; further in, another smaller; but not a trace of a vascular bundle on either side. Lower down, where the cavity of the stigma is much expanded, we find three vascular bundles, but in a straight line from the upper surface to the cavity of the stigma. The three vascular bundles cannot therefore denote three stamens, but belong only to the one stamen and the style, in which the vascular bundles usually surround the stigmatic canal on two or three sides. The lateral wings, which are here very thick and arched, certainly have delicate spiral vessels, but horizontal in direction, while if they belonged to stamens they ought to run vertically from below upward.

When we examine, further, the column of one of the *Vandææ* or *Epidendrææ*, we find the operculum of the anther, which likewise represents a connecticulum, distinctly surrounded by another part, which is very often furnished with various appendices and wings, clearly belonging to the external envelope of the column. I have given an enlarged transverse section in my Anatomical Plates, pl. 19 & 20, from *Epidendrum elongatum*. Here the stigmatic canal is surrounded by a quantity of vascular bundles,

among which one on each side might readily be supposed to indicate a stamen on each side. The other canal, which is there represented, originates from the confluence of the labellum with the column, and whenever fertilization was artificially effected, I found pollen-tubes in this canal also. Similar transverse sections of the column of other *Vandææ* always exhibit a quantity of vascular bundles surrounding the stigmatic canal. It is clear therefore that there is still another part which surrounds the column, and with the labellum represents a special organ, which must be referred to the Linnæan nectary or to an accessory corolla (*paracorolla*). This accessory corolla has two lips; one, the upper lip, blended with the column, the lower lip being the labellum.

The comparison of the Orchidaceæ with the Alpiniaceæ lies near, and indeed has been occasionally made, although mostly superficially. The calyx of the Alpiniaceæ is spathaceously trifoliate, and, according to Lindley, corresponds to the calyx of the Orchidaceæ: the corolla of the Alpiniaceæ always has two divisions; the outer tripartite envelope can only be compared, according to Lindley, with the corolla of the Orchidaceæ, where however that third leaflet is wanting, being absorbed, as it were, into the labellum situated above it. There is nothing in the flower of the Orchidaceæ corresponding to the inner division of the flower of the Alpiniaceæ, unless the envelope of the column, above spoken of, is taken into consideration. This, together with the labellum, corresponds to the inner portion of the flower of the Alpiniaceæ, in which there is always a well-marked labellum, and very often, for instance in *Hedychium* and *Globba*, an upper lip, which is merely not blended with the stamens and style as in the *Vandææ*. This upper lip is often wanting and the labellum exists alone, as in *Alpinia*, *Zingiber* and *Kämpferia*, just as in our indigenous *Ophrydeæ*. The connecticulum is very much expanded in the Alpiniaceæ, and so it is in the common anthers of the *Ophrydeæ*, as well as in the calyptrate anthers of the *Vandææ*, and indeed in all Orchidaceæ the two anther-cells are connected above by a membranous or fleshy portion, which may be aptly named a connecticulum.

As to the anthers, I will merely observe that the pollen of the *Vandææ* does not always lie naked upon the cellular body which serves as its basis, but is inclosed in a delicate membrane of angular parenchymatous cells, as I have distinctly seen in many, particularly in *Huntleya violacea*.

Cypripedium is not diandrous. The column divides into two branches, each of which bears an anther-cell with two pollen-masses. This division of the column alone distinguishes this genus from the rest. Only one anther exists, but its chambers are very much separated, as is usual in the Alpiniaceæ. My re-

searches were made on *Cypripedium spectabile*, as the commonest species in our gardens. When we examine a transverse section of the column, it may readily be imagined that the two anthers are actually separate. There are three vascular bundles around the stigmatic canal, and besides these, another above and one on each side, as if belonging to two anthers. But we see just the same in *Calanthe veratrifolia*, to which we certainly cannot ascribe two separate anthers. As a general rule however, there exist other vascular bundles besides the three situated around the stigmatic canal; these have already been spoken of.

In regard to the stigma, there is no doubt that we must, with Robert Brown, call it three-lobed. In every transverse section made through the column, we find a triple excavation of the stigmatic canal. These excavations are often divided again. Thus we find it in *Gongora maculata*, of which I have given a magnified representation in the Anatomical Plates (Heft i. tab. 20); also in *Stanhopea eburnea* and *Mavillaria macrochila*, &c. Lindley's view that the capsule is composed of six carpellary leaves is confirmed by transverse sections at the apex of the germen.

I have nothing new to add to what I formerly made known relating to the remarkable structure of the germinating embryo (Select Anatomico-Botanical Plates, part 2. pl. 7); and I still believe that the embryo is not a tuber, in its rudimentary condition, but is nevertheless formed in an analogous manner.

It might be said that the formation of tubers is an especial peculiarity of the Orchidaceæ, for when the roots are not tuberous, the stem strives to become so. The *pseudo-bulbi*, as Lindley calls them, are tuberously-developed internodes. The internal structure is the same as in the stem of Monocotyledons in general; woody bundles are situated in a circle in a loose parenchyma; only here, from the thickness of the internode, there are more circles than is usual elsewhere. A speciality occurs in these. Each woody bundle is composed, as usual, internally of spiral vessels, on the outside of which lie pseudo-porous vessels; to these follow pseudo-porous parenchymatous cells which become successively narrower, and at last appear as prosenchymatous cells; at the outside, where the larger parenchyma begins, lie the tubercular tubes of which I will speak immediately. Toward the interior, near the axis of the tuberous internode, we find the same series, only the pseudo-porous vessels are wanting. Those tubes which I have mentioned are relatively rather wide, without transverse septa, so far as I have examined, and, at regular intervals, stand elliptical papillæ surrounded by a rim of the same form. At first sight they appear like the common so-called pores or bright spots, but they project distinctly from the front of the tubes, and are more or less filled with a dark gra-

nular mass, which however is sometimes absent. They stand on all sides of the tubes, both toward the axis and toward the periphery of the internode. I have found them in all the Orchidaceæ that I have examined, but never in stems which are not thickened, nor in the leaves*.

Finally, a few observations on the aërial roots of the Orchidaceæ. They seldom pass into the earth, even when this is placed in their way; they grow on long and freely in the air, nay sometimes in an upward direction. Only to the cracked bark of trees, to which the plants are attached, they adhere by means of fine hairs. Meyen observed that the outer layer of these roots is composed of spiral cells, and this layer is of tolerable thickness. This is succeeded by a rather lax parenchyma, but in the vicinity of the ligneous nucleus, as I will temporarily call it, scattered spiral cells occur again, their convolutions being more lax. The ligneous nucleus is composed, as in the roots of all Monocotyledons, of one or more circles of vascular bundles, in a parenchyma of narrow cells, which are narrower than in the rind, and therefore form no true pith. In the hairs a delicate spiral fibre is rolled up in close convolutions, but the base is expanded and devoid of spiral fibres, although spiral cells lie beneath. Moreover these hairs, like all radical hairs, have no transverse septa. The occurrence of abundance of spiral cells directly in these aërial roots, which very seldom descend into the earth, may contribute to the discovery of the at present enigmatical function of these cells, since they never absorb nor carry onward coloured fluids, like the spiral vessels.

VI.—On the occurrence of *Charadrius virginiacus*, Borkh., at Malta. By H. E. STRICKLAND, M.A., F.G.S.

I HARDLY know whether the occurrence of a new or unrecorded species of bird at Malta is to be regarded as forming an addition to the European fauna, because geographers are I believe not yet agreed as to whether Malta belongs to Europe or to Africa. But in either case the discovery of *Charadrius virginiacus* at Malta is not the less interesting, for this species has not as yet, I believe, been noticed in either of those two quarters of the globe to which that island is intermediate.

I have lately found an accidentally mislaid letter, addressed to me in 1846 by Capt. H. M. Drummond, 42nd R.H., whose valuable papers on the birds of Corfu, Crete, Macedonia, and

* Lindley remarked the existence of these tubercles in *Oncidium altissimum*, in his 'Introduction to Botany,' but gave no particular account of them.—A. H.

Tunis are well known to the readers of the 'Annals.' In this letter he mentions having procured at Malta "a little golden plover, which, on comparing with *C. pluvialis*, I find quite distinct, being only the size of *C. morinellus*, and much longer in the tarsus. It was shot in company with another of the same species in March 1845. They are occasionally observed in Malta every second or third year, generally early in spring, and have never been noticed in company with *C. pluvialis*, but generally solitary or in pairs. They have not been observed with black on the breast. The man who shot it informs me that he has frequently killed them, and that he can immediately recognise them by the note, which is peculiar, differing from that of *C. pluvialis*, and more resembling that of *C. hiaticula*."

Capt. Drummond has subsequently been in England, and showed a specimen of this bird to Mr. Yarrell, who ascertained it to be the *Charadrius virginiacus*.

This species possesses a far more extensive geographical distribution than the better-known *Charadrius pluvialis*. The latter occurs throughout Europe, and is recorded as far east as Trebizond and Siberia. But *C. virginiacus* not only frequents the whole of North and South America, but extends over the Polynesian Islands to the Malay Archipelago and India, as well as to Australia and New Zealand*. We have now evidence of its visiting Malta for a short time early in spring, a fact which clearly proves that it must winter in Africa, and, occasionally at least, pass the summer in some part of Europe, though it has never yet been obtained in either of these continents. This has probably been owing to the resemblance of its plumage to that of *C. pluvialis*, which bird is recorded by Malherbe in his 'Faune Ornithologique de la Sicile,' by Schembri in his 'Catalogo Ornitologico del Gruppo di Malta,' and by Von der Mühle in his 'Beiträge zur Ornithologie Griechenlands,' but without any indication of their having noticed the *C. virginiacus*.

The distinctions between *C. pluvialis* and *C. virginiacus* are numerous, and are carefully pointed out by Sir W. Jardine in his edition of 'Wilson's American Ornithology,' vol. ii. p. 362. It will therefore suffice to mention here that *C. virginiacus* is rather smaller than *C. pluvialis*, has rather longer tarsi, and has the under wing-covers and axillary feathers of a gray brown, while in *C. pluvialis* they are pure white.

* The Australian *C. xanthocheilus* of Jardine's 'Illustrations of Ornithology,' plate 85, and of Gould's 'Birds of Australia,' vol. vi. plate 13, is certainly identical with *C. virginiacus*. The true *C. xanthocheilus* of Wagler inhabits New Zealand (in company with *C. virginiacus*); and, according to Mr. Gray's Catalogue, there are three specimens of it in the British Museum from Van Diemen's Land, though it seems to be omitted by Mr. Gould.

American specimens of *C. virginicus* are somewhat larger than the Indian and Maltese ones. Both varieties however have been recently found by Capt. Drummond in Bermuda. In a list of the Birds of Bermuda by Mr. H. B. Tristram, which is on the point of being published by Sir W. Jardine in his 'Contributions to Ornithology,' these two varieties are regarded as distinct species, as appears from the following passage: "No. 46, *Charadrius marmoratus* [i. e. *virginicus*], American golden plover. No. 47, *Charadrius*?, an unnamed species smaller than the American and perfectly distinct. Not unfrequent here. It has been also found in Malta by Capt. Drummond, 42nd R.H."

VII.—*Notice of a new Genus of Cestoid Worm.* By M. P. J. VAN BENEDEN*. Communicated by J. T. ARLIDGE, A.B., M.B., (Lond.).

THE researches of M. Beneden in the lower forms of animal existence have rightly secured him the reputation of an original, diligent, and careful observer; and every communication therefore from him deserves the attention of the naturalist. This leads us to give an abstract of his notice of a new genus of Cestoid Worms, and of a proposed amended arrangement of them.

M. Beneden discovered the new entozoon at the commencement of the spiral intestinal lamina of the skate, in company with other worms of the genus *Bothriocephalus*. Before entering on its description, he would premise that, as the *Cestoideæ* go through several phases of existence, a species is not represented by the adult state only, but by its several successive generations by gemmation, and of which the last only is furnished with sexual organs; and that it is consequently necessary to describe separately those various phases and to give them special names.

Thus the first stage of existence may be called the *scolexoid*, being that of the *scolex* or young worm on its escape from the ovum; the second, the *strobiloid*, from the word *strobilus* of M. Sars, designating the analogous stage of the *Medusæ*; the third and last, the *proglottoid*, from the term *proglottis*, applied by M. Dujardin to the separated joints of the *Cestoideæ*.

Owing to the striking peculiarities of the newly-discovered worm, M. Beneden has felt it necessary to constitute a new genus, of which it is at present the only example. This new genus is designated *Echinobothrium*, and presents the following characters:—

First, or *Scolexoid* generation, unknown.

* Extracted from vol. xvi. of the 'Bulletin de l'Académie Royale de Belgique.'

Second, or *Strobiloid*. The body elongated, flattened, terminated by a distinct head, assuming the form of a hammer, and having two rows of hooks; neck supporting three rows of spines on each side. The lemniscus protrudes in the median line. Length of worm 5 to 6 millimetres.

Third, or *Proglottoid*. Body elongated, rounded, no external opening except that for the lemniscus to escape; lemniscus rugose at the base, and when unrolled nearly as long as the body. Length of body 1 millimetre. Ova very minute, $\frac{1}{100}$ th of a millimetre in diameter.

Echinobothrium typus. *Scolexoid* stage unknown. In the *Strobiloid*, a distinct head, neck and trunk exist. The general form is that of Helminthoid worms,—that one mostly assumed by naturalists to be the perfect condition of such beings.

The head resembles in its great mobility that of *Scolex*, or of *Tetrahynchus*. It may elongate itself into the figure of an arrow-head, or become contracted into a rounded form; and such changes take place with astonishing rapidity. The head is flattened like the rest of the body, and has two overlying very contractile fleshy lobes applied to one another. Within the head and towards its fore-part lies a bulb, rather more transparent than the surrounding tissues, and supporting two rows of hooks, one beneath the other, as seen on viewing the flat surface of the head. This bulb expands itself abruptly, giving off a process on each side the head, which then resembles in figure that of the hammer-headed shark. The hooks previously seen within the head now fringe the extremities of these processes, and in situation resemble that of the eyes of the fish just named. This appearance is to be seen only in certain positions of the head.

Nine of these hooks have been counted disposed in one row; they are all of about the same length and shape, tapering to a point which is curved inwards, and exhibit near their middle a slight enlargement. They are very readily detached.

In the interior of the head, posterior to, and nearer the surface than the bulb, are four flexuose cords, extending thence to the last joint of the animal. These cords resemble those met with in most Tenioid worms, and which M. E. Blanchard has, in some examples, succeeded in injecting.

The neck is clearly defined by constrictions, from the head in front and the trunk behind. It is nearly as long as the head, flattened like it, but narrower; and on each side is armed with three rows of spines, in which circumstance this worm differs from all other Helminths. The spines are nearly of the same length, straight, tapering, with a trifid base imbedded in the soft substance of the animal. Each row has twelve to thirteen closely

implanted but distinct spines, directed backwards, and like those of the head easily separable.

The trunk forms the remainder of the body, made up of numerous segments, first indicated by delicate lines, and towards the posterior extremity by deep constrictions, which ultimately end in transverse fission.

The individual joints constitute the last or adult phase of the worm on the completion of their development, which may occur before their separation from the strobiloid animal. The four cords seen in the latter belong also to this third generation, which however alone possesses a sexual system.

The development of these segments is by gemmation, differing it will be found in no essential points from that in *Polypes*, if an extended view of the process be taken.

Third or *Proglottoid* generation. Along with yet entire articulated worms, joints are met with living independently as *Trematodes*, but are the analogues of complete or adult *Medusæ* derived from the fission of the *Strobila*. After their separation from the strobiloid parent, these joints increase in size so considerably as to equal that of two or three yet attached segments.

They also undergo a change of form;—losing their flat ribbon-like form, they become rounded or purse-shaped. In general characters and in their movements they resemble *Planariæ*, but have been yet more frequently confounded with *Trematoda*.

Their investing integument offers nothing peculiar. Its surface presents neither cilia nor folds, but is occasionally furrowed. Its continuity is uninterrupted, except at the opening by which the lemniscus escapes; no mouth or respiratory organ being apparent. The internal organs maintain an adhesion with the external wall.

No evidence supports the notion that the organ variously called the lemniscus, cirrus, cirrhule, and penis, belongs to the reproductive apparatus; and the observation of the passage of spermatozoa by it is illusory, for we have examined this organ in every stage of development, and at the period of its greatest vigour, without perceiving the least indication of such a passage. The anatomical character of the lemniscus is also opposed to such a phenomenon.

In our opinion this appendicular organ performs the same office as the tubes of the *Tetrarhynchus*, viz. that of affixing the animals to the tissues, or of infolding them more completely in the mucus in which they live.

Its position varies in different genera: in the *Helminth* in question it occupies the median line about the posterior third of the body. It is distinguishable when inclosed in its sheath; is

larger at the base, where it is covered with asperities, and when unrolled nearly equals the body in length.

The lemniscus is also lodged in a sac resembling the sheath of the tube of *Tetrarhynchus*, and unrolls itself like that tube. A very perceptible retractor muscle arises from the bottom of the sheath, and thence extends to the extremity of the lemniscus.

We agree with Siebold, that, like as in the *Trematoda*, the *Nematoidea* and other worms, there exists one organ for the formation of the germ, and another for that of the vitellus. The germigenitor (*germigène*) occupies almost the whole length of one side of the body, having a coiled form, and is easily detected when containing germs.

The vitellogenitor (*vitellogène*) is made up of cells more or less round, often very clear, and which are distributed throughout the parenchyma in large number. Ova in their interior are often to be seen in course of development. We believe that the cells rupture, scattering the vitelline globules in the cavity of the body, which then envelope the germinal vesicles after they have undergone contact with the spermatozoa.

A dull white organ is also seen in the centre of the body, which, when the animal is compressed, appears a tortuous cord, like the testes of insects. It has distinct walls, and may be completely uncoiled. We have supposed this tube might terminate at the base of the lemniscus, but have been unable to determine this opinion by observation. We regard this organ as the testes, but do not think it discharges its product externally.

In the interior of the body we have observed ova in course of development, having experienced the action of the spermatozoa; but as there is no perceptible opening externally, we are compelled to admit fecundation to result from the spermatozoa of the same animal, which implies complete hermaphroditism.

Helminthologists generally admit the existence of natural vents for the escape of the reproductive products, but, in the worm described, nothing of the sort is seen. When the skin of an animal, on the object-glass of the microscope, ruptures, the ova escape through the rent.

The ova are very small, measuring but $\frac{1}{100}$ th of a millimetre, but are not otherwise remarkable. It is worth while to observe, however, the great difference in size the ova present in animals closely allied. Thus in *Bothriocephalus flos* the ova at the time of their discharge have eight or nine times the volume, and admit of the ready observation of their cells in process of organization.

Affinities.—The *Echinobothrium* is allied to the *Bothriocephalæ*, but cannot be included in that or any established genus. In seeking to classify this worm we have been struck with the sin-

gular confusion presented by the genus *Bothriocephalus*, and with the necessity of another arrangement of Cestoid worms.

The primary character to be adopted is taken from the presence or absence of hooks on the head, according to which we divide the *Cestoideæ* into *Acanthocephalæ* and *Anacanthocephalæ*. The first, the more numerous, forms two very natural families, one of which has a circle of hooks with four surrounding sucking-disks, whilst the second possesses from two to four extremely contractile lobes. The former family is that of the *Tenioideæ*, the latter that of the *Bothrioideæ*, which includes a portion of the *Bothriocephalæ*.

The *Anacanthocephalæ* are at present constituted of a single family, embracing all the unarmed *Bothriocephalæ*.

We present the following as the first sketch of an arrangement of the *Cestoideæ*, for numerous investigations are still needed to acquaint us with all the genera at each epoch of their development.

CESTOIDEÆ.

Section I. ACANTHOCEPHALÆ.

Family I. *Tenioideæ*.

Genera.	Tenia	Tenia Solium.
	Halysis	H. genettæ (Gerv.).
	Trienophora	T. nodosus.

Family II. *Bothrioideæ*.

Genera.	Acanthobothrium, n. g.	Bothriocephalus bifurcatus.
	Echinobothrium, n. g.	E. typus.
	Dibothryorhynchus . . .	D. lepidopii.
	Tetrarhynchus	Rhync. corollatus.

Section II. ANACANTHOCEPHALÆ.

Family I. *Bothriocephalidæ*.

Genera.	Phyllobothrium, n. g. .	Bothriocephalus tumidulus.
		B. flos.
	Fimbriaria ?	Tenia malleus.
	Bothridium	B. megaloccephalum.
	Bothriocephalus . . .	B. latus.
		B. punctatus.
	Schistocephalus . . .	B. solidus.
	Cryptocephalus, n. g.	

VIII.—*Description of a new species of Veronica.*

By JOHN BALL, M.R.I.A.

SEVERAL years ago I gathered upon the steep crags of the Pagna della Croce, one of the highest peaks of the Apuan Apennines, specimens of a *Veronica* which accidentally remained unexamined until the present year. Although resembling in many respects *V. aphylla*, L., my specimens differ in so many essential particulars, that I am induced to distinguish them by a specific name; and I subjoin a description of the proposed new species, together with that of *V. aphylla*, from which the diagnosis will more readily be made.

V. longistyla, nobis. Caule brevissimo, repente, cæspitoso, filiformi; foliis inferioribus minimis, superioribus subrosulatis, omnibus obovato-spathulatis, *acutiusculis, grandiuscule crenato-serratis*; pedunculo scapiformi *adscendente*, vix pollicari, supra in pedicellos, 2–4 erectos, *bracteis linearibus et capsulis 3–4 longiores*, diviso; corolla parva, *filamentis styloque breviori*; capsula matura *late obcordata, profunde emarginata, calycem sesquilingua, stylo breviori*, seminibus lentiformibus, *albo-hyalinis*, glabris. Herba tota pilis brevissimis articulatis, superne glandulosis, adspersa.

V. aphylla, L. Caule brevissimo cæspitoso; foliis rosulatis, late obovato-spathulatis, *obtusis subintegerrimis*; pedunculo scapiformi erecto, 1–3 pollicari; supra in pedicellos 2–4, *bracteis capsulisque vix duplum longiores*, diviso; corollæ segmentis latis, filamenta stylumque superantibus; capsula matura *obovato-elliptica, sinu brevissimo emarginata, calyce et stylo duplum longiore*; seminibus lentiformibus, luteis, glabris. Herba tota pilis articulatis, glandulosis, crebris, oblecta.

V. longistyla differs at first sight from *V. aphylla* in its smaller size, more slender habit, and in its less abundant and less glandular pubescence; but the most certain characters must be sought in the completely different shape and much smaller size of the capsule, and in the much greater length of the style, which is longer instead of being one-half shorter than the ripe capsule, as in *V. aphylla*. I have to call attention to the description of the capsule of *V. aphylla* given by Mr. Bentham in the tenth volume of the 'Prodromus.' It is there stated that the capsule is *obcordate*, and that eminent botanist, to whom I have submitted a specimen of *V. longistyla*, observes, "I do not find so much difference in the form of the capsule;" he however further observes, "I have but one specimen of *V. aphylla* in good fruit." I have gathered *V. aphylla* in fruit in Dauphiné, in the cantons of Berne, Glaris, Tessin, and Valais in Switzerland, in the Tyrol, and in several parts of the Carpathians, and with the specimens before me I do not find any difference in the form of the ripe fruit, which is as I have above

described it, with a very slight notch at the summit, and by no means obcordate. The descriptions of other eminent authors are by no means concordant. According to Koch and Wahlenberg the capsule is obcordate; Bertoloni describes it as "*subrotundata emarginata*;" while Reichenbach says, "*capsula obovato-triangulari, vix emarginata*." I am disposed to believe that the Italian plant known to Bertoloni, and possibly also the specimen in good fruit preserved in Mr. Bentham's herbarium, may be *V. longistyla*, while the common alpine plant known to Reichenbach is the true *V. aphylla*.

The difference of habit and appearance between the plant here described and the ordinary *V. aphylla* might be referred to the peculiarity of its birthplace upon the arid marble rocks of the Carrara Apennines; but it would be a large concession to the views of those who most believe in the modifying influence of external conditions, to suppose that they can so far change the form of the essential organs of vegetation as would be required if these plants be not specifically distinct.

Having lately received Corsican specimens of *Veronica repens*, Lois., from my friend M. Jordan of Lyons, I may remark that that plant appears to me to be a mere variety of *V. serpyllifolia*, L. It differs from the mountain form of that plant, known to the Scotch botanists as *V. humifusa*, Dicks., in no respect except in the somewhat more hairy segments of the calyx, and apparently in the leaves being rather more fleshy than in the Scotch plant.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Jan. 9, 1849.—William Yarrell, Esq., Vice-President, in the Chair.

The following papers were read:—

1. DESCRIPTIONS OF THREE NEW SPECIES OF DELPHINIDÆ. BY J. E. GRAY, ESQ., F.R.S.

The species which form the subject of the present communication were collected by Dr. Dickie, R.N., during his voyage in the Pacific, and have been transferred by him to the British Museum.

DELPHINUS EUTROPIA.

Nose of skull rather longer than the length of the brain-cavity, rather dilated on the sides before the notch, very convex and rounded above; triangle elongate, produced before the tooth-line, concave on the sides, and strongly keeled in the centre behind; hinder edge of blow-hole rather prominent. Intermaxillar wide, convex above, leaving a rather broad open space in front. Palate rather concave in front, convex in the centre behind, the hinder part keeled on each side.

Lower jaw thick, blunt, and rather produced beyond the upper in front. Skull rather compressed behind. Teeth $\frac{34}{33}$, rather slender, cylindrical, conical at the top. The frontal ridge half the distance between the notch and the convexity of the condyles; condyles large, rather oblique; foramen magnum rather wider than high.

	in.	lin.
Length, entire	15	0
—— of beak	7	10
—— of teeth-line	6	10
—— of lower jaw	11	11
Width at notch	3	6
—— at orbit	6	5
—— at middle of beak	2	10
—— of middle of intermaxillar . .	1	3
—— at condyles above	3	3
Height of each condyle	1	3
Skull from notch	6	10

LAGENORHYNCHUS CLANCULUS.

Skull wide and rather high behind; beak flat, outline wide at the base, rapidly tapering and acute in front, but rather convex on the sides; sides slightly rounded, the hinder edge near the notch only slightly turned up and rounded; lower jaw high behind; triangle extending to near the middle of the beak. Teeth $\frac{33}{32}$, small, cylindrical, curved, rather acute at the top; the lower front one very small. Intermaxillaries broad, hard.

	in.	lin.
Length entire	14	6
—— of beak	7	3
—— of skull	7	3
—— of teeth-line	6	6
—— of lower jaw	11	3
—— of symphysis of lower jaw . .	1	4
Width at notch	4	2
—— at orbit	7	6
—— at middle of beak	2	7
—— of intermaxillar in middle .	1	4
—— of condyles above	2	10

Hab. Pacific.

Very peculiar for the elongation and reflexion of the beak before the notch, and the regular beveling of the sides of the beak.

LAGENORHYNCHUS THICOLEA.

Skull rather narrow behind; beak elongate, almost one-fifth longer than the length of the head, rather dilated and concave above behind, with the side edges in front of the notch elongated, keeled, and turned up; the middle of the beak flat, with flat shelving sides, the shelving part being broader, and forming a slight keel in front. Intermaxillaries flat, gradually tapering. Triangle to the middle of the beak concave on

the sides, and keeled in the middle behind. Teeth $\frac{40}{40}$? very slender, curved, elongate, conical, tapering, acute; the front very small.

	in.	lin.	
Length of skull entire	14	6	end of nose injured.
——— of beak	8	4	
——— of teeth-line	7	0	
——— of lower jaw	12	3	entire.
Width at orbits	7	0	
——— at notch	3	11	
——— at middle of beak. .	2	2	
——— of intermaxillary } in middle }	1	2	
Width of condyles	3	0	

Hab. West Coast of America.

2. DESCRIPTIONS OF APPARENTLY NEW SPECIES OF APTERA FROM NEW ZEALAND. BY ADAM WHITE, F.L.S. ETC.

MYGALE (CTENIZA) ANTIPODUM.

Chelicera deeper than long, ochrey-brown, the top at the base somewhat hollowed, smooth; sides smooth, front and tip with several short hairs.

Cephalothorax rotundo-ovate, pale ochrey-brown, the sides in front somewhat grooved. Eyes situated on a slight elevation in front of cephalothorax: the two posterior eyes on each side close to each other.

Legs of a pale brown, but deeper in colour than the cephalothorax.

Abdomen of the same pale brown as the legs, covered with rather long hairs; the tail nearly as long as the abdomen, the terminal joint elongate, slender, gradually thinner.

Hab. New Zealand.

MYGALE (CTENIZA) HEXOPS.

Chelicera deep black, much deeper than long; above somewhat narrowed; the top and the greater part of the sides quite smooth; the front and a narrow line on the sides slightly punctured, each of the punctures supplied with a hair.

Cephalothorax fulvous yellow, oval, somewhat truncated behind and slightly sinuated; two small silky whitish spots on the fore-part behind the first row of eyes; eyes situated on a slight elevation of cephalothorax, which is deep brown; a narrow brown line extending down the middle of the back, but not reaching the end.

Legs of a pale brown, sparingly furnished with rather long hairs; the femoral joints somewhat thickened.

Abdomen black, covered with shortish hairs, which in some lights have a greyish tinge; the hairs on the under side of the body greyish.

Tail about half the length of abdomen; the last joint the longest, and gradually more slender from the base.

Hab. New Zealand (Port Nicholson).

This species is very remarkable from its possessing only six eyes.

DOLOMEDES LATERALIS.

Cephalothorax of a very pale brown, with a faintish line down the

middle; a very distinct white line from the anterior angle of the cephalothorax, continuing down the side and carried along each side of the abdomen; the cephalothorax and abdomen on the inner edge of the white line of a deeper brown colour; the legs and palpi of a pale ochrey-yellow, with many black hairs.

Chelicera covered with greyish hairs.

Hab. New Zealand.

This species, which is described from a male, differs from the *Dolomedes mirificus*, Walck. Apt. i. 355, and the *Dolomedes sagittiger*, as well in markings as in size.

DOLOMEDES SAGITTIGER.

Cephalothorax of a very deep brown; the extreme edge of the sides, where the legs are inserted, pale; a wide yellowish longitudinal line from the anterior angle of cephalothorax; the outside edges with some brown points; the inner edge with some sinuations; the band does not reach the end of the cephalothorax; the middle of the cephalothorax with a narrow white line extending from behind the second line of eyes, almost to the end; on each side of it in front a short interrupted line, somewhat rounded in front.

Abdomen deep brown, the sides of a palish hue as far as the middle.

The eyes of the first row very small.

Legs deep brown, with darker coloured hairs.

Hab. New Zealand.

This species seems to be closely related to *Dolomedes mirificus*, Walckenaer, Aptères, i. 355.

ATTUS DARWINII.

Chelicera black, with greenish reflexions, punctured and striated in front, and somewhat impressed at the end; palpi pale brown.

Cephalothorax deep blackish brown, highly polished, considerably paler in the middle of the back; front part projecting very considerably over the chelicera; the front edge behind the first row of eyes with several tufts of short close-set black hairs.

Eyes with the middle pair of first row very large; the lateral eyes of first row placed somewhat behind the middle pair, and larger than the two hind eyes; the eyes on the second line very small, nearer the lateral eyes of first row than those of the third.

Legs: First pair very long, deep blackish brown; femoral joint rather longer than the tibial, which is double the length of the genual joint; the tarsal joint pale at the end; a small spine near the end of the femoral joint on the inside; a longer spine about the middle of the genual joint; three spines placed after each other on the inner edge of tibial joint; second, third and fourth pairs of legs of a pale yellow, smooth, with a few short bristly hairs on the inside and outside.

Abdomen small, at the base projecting slightly over the cephalothorax with a broad pale line down the middle; an impressed dark longitudinal line in the middle.

Hab. New Zealand.

This makes a third species of *Attus* from New Zealand; the other

two recorded species are *Attus abbreviatus*, Walek. Aptères, i. 477, and *Attus Cookii*, Walek. i. 478. Most probably the *Attus Phri-noides*, Walek. i. 479, is from the same country, and doubtless many other species will yet be found.

SPHASUS GRACILIPES.

Cephalothorax and abdomen covered with shining silvery hairs.

Legs fulvous.

Cephalothorax narrowed in front, with a slight groove from the end of the narrowed part on each side extending to the middle of the back; the posterior part ovate.

Abdomen nearly three times the length of the cephalothorax, much-elongated and attenuated at the end.

Hab. New Zealand.

EPEIRA VERRUCOSA, Walckenaer, Aptères, ii. 135.

Hab. New Zealand.

The specimens in the Museum collection are not in very good condition, but seem to agree in nearly every important particular with the species to which I have referred it; the posterior lateral eye however can scarcely be said to be almost on the same line as the anterior.

TEGENARIA ANTIPODIANA.

Labium nearly as wide as long, truncated at the end.

Cephalothorax gradually convex above, deep ferruginous brown, with two wide longitudinal fulvous bands.

Legs ringed with yellow and brown, the first two legs with the rings obsolete.

Abdomen as long as cephalothorax, but not quite so broad, apparently without any impressed points in the middle.

This species appears to differ from the *Tegenaria australensis*, Walckenaer, Aptères, ii. p. 12. Lucas, Ann. Soc. Ent. France, in many particulars, especially in the marking of the cephalothorax and the shape of the labium.

DANDRIDGIA DYSDEROIDES.

Chelicera as long as the cephalothorax.

Cephalothorax elongated, square in front, slightly wider just behind the middle; a slight groove down the middle.

Eyes situated on two lines, the posterior line the longer; the two middle eyes of first line nearer each other than the outer eye; the posterior line with the middle eyes rather nearer each other than the side eyes.

Legs elongated, first pair the longest, second pair rather longer than the fourth, the third considerably shorter than the fourth.

Abdomen small, shorter than cephalothorax, smooth.

Hab. New Zealand.

Named after Mr. Joseph Dandridge, an apothecary, who lived in Moorfields more than a hundred years ago, and who has left copious evidence in his MSS. (now preserved in the British Museum) of his love of arachnology.

PHALANGIUM LISTERI.

Chelicera enormously long; first joint not quite so long as the

second, and like it rough, with outstanding short spines, the end very slightly thickened; the end of the second joint gradually thickened, with two claws, one fixed, with a small tooth inside near the base, followed by a deepish notch; the moveable claw with a largish tooth about the middle, which fits into the notch of fixed claw.

Hab. New Zealand.

CHELIFER PALLIPES.

Claws and body of a deep brown, the legs pale, the claws with a greenish hue, and furnished with many pale hairs; abdominal segments edged with palish; the femoral joints of legs much-compressed.

Hab. New Zealand.

3. NOTICE OF THE CAPTURE OF ORTHAGORISCUS MOLA OFF THE CHESIL BANK, DORSETSHIRE. BY MAJOR PARLBY.

In this communication, which was addressed in the form of a letter to Mr. Gray, Major Parlby stated that in the beginning of June 1846 the specimen in question was observed almost daily in the West Bay, sometimes sailing about slowly with half its dorsal fin above the surface of the water, sometimes moving with great rapidity, playing about and splashing the water violently, or blowing like a whale or grampus.

As it generally kept off and on between the mackerel and the shore, the fishermen attributed their ill success with the shoals, which never left the deep water, to the presence of this unusual visitant; and it is remarkable that on the day after its capture they took upwards of 20,000 fish.

The capture happened on the 13th of June, in consequence of the Sunfish swimming directly into the centre of the line of nets. When entangled in the first net it exerted itself so powerfully that it broke through, and was only secured by the yawl or outer net and the co-operation of about forty men, who finally succeeded in landing it on the Chesil Bank: and even here its vigour was so great that it dashed about the pebbles, according to the fishermen's account, like a shower of grape. It expired in about three hours, after uttering "hideous groans," like those of a horse dying of the staggers.

On the capture becoming known to Major Parlby and Mr. Fox, surgeon, of Weymouth, they hastened to inspect the fish, and found that the skin was entirely covered with a white mucous slime, upon the removal of which the real colour of the integument was discovered to be of a dull dirty brown colour, and the texture to resemble the most beautiful shagreen.

Major Parlby and Mr. Fox having jointly purchased the fish, proceeded to have it prepared for the British Museum, to which institution they subsequently presented it.

The dimensions are as follow:—

	ft.	in.
Total length	6	3
Height of dorsal fin	2	5
Breadth of it at base	1	3
Height of ventral fin	2	3
Girth	9	0

January 23.—William Yarrell, Esq., Vice-President, in the Chair.

The following papers were read :—

1. ON SOME NEW OR LITTLE-KNOWN SPECIES OF MONKEYS.

By JOHN EDWARD GRAY, Esq., F.R.S. ETC.

The older authors have described two species of *White-nosed Monkeys* which have been called *Hocheurs* by the French.

In the British Museum we have specimens of each of these species, and also of two very distinct kinds, which appear either not to have occurred to preceding authors, or to have been confounded by them with the species described by Erxleben.

CERCOPITHECUS MELANOGENYS. The Black-cheeked Monkey.

Dark olive, minutely yellow grised; face, cheek, forehead, chest and hands black; a large cordate spot on the nose and a small spot on each temple white. Throat, under-part of the body and inside of the legs whitish; the front of the shoulders, outside of the limbs, end of the tail blackish. Ears, the middle of the back, and upper part of the tail, rufous.

In the British Museum collection there is a half-grown specimen of this species which died in a menagerie near London, and was said to have come from Western Africa.

The Black-cheeked Monkey is easily known from *Cercopithecus nictitans* by its yellow punctulated fur and cordate form of the spot on the nose; the latter character equally distinguishes it from *Cercopithecus petaurista*, from which it is also separated by the blackness of its cheeks and the greyness of the outside of the limbs, and the redness of the middle of the back and the tail.

This species was indicated in the 'Annals of Natural History' for 1845, but is redescribed here for the purpose of comparison with the next.

CERCOPITHECUS LUDIO. The Ludio.

Blackish, minutely yellow grised; face, temple, crown of the head, shoulders and fore-legs, black; outer side of the hinder legs and end of tail blackish; large oblong spot on the nose white; throat, upper part of the inside of arms, and lower side of the body, whitish; rump and under side of base of tail dark reddish brown.

Hab. West Africa.

In the British Museum there is a nearly full-grown specimen of this species, which was procured from a menagerie in Liverpool, and was said to have been brought from the west coast of Africa.

This is at once known from two other species which have the fur punctated with yellow, viz. *C. petaurista* and *C. melanogenys*, by the large size and erect oblong form of the white spot on the nose, and especially by the absence of any white on the cheek or temples; it is easily distinguished also by the general black tint of the fur, and especially by the red hairs of the rump.

In the course of last year there was exhibited in the Gardens of the Society a short-tailed American monkey, which was regarded by several

eminent zoologists as a species of *Cebus* which had lost part of its tail ; but there was a peculiarity in the position of the thumb as regarded the fingers, which at once showed that whatever might be the natural length of its tail, it evidently did not belong to the genus *Cebus* as at present restricted. The examination of the animal after death showed that it was a most distinct genus, and nearly related to, if not a variety of, *Brachyurus Ouakari* of Spix.

I may observe that the genus *Brachyurus* was established by Spix in his work on American Monkeys for two species, viz. 1. the *Simia Chiropotes* of Humboldt (the *S. Sagulata* of Trail), which has been generally referred to the genus *Pithecia* ; and 2. *Brachyurus Ouakari*. Spix in the same work restricted the genus *Pithecia* to the *Saki* or Long-haired American Monkeys.

The examination and comparison of the skull of the short-tailed monkey and of the allied genera have induced me to think that the American Monkeys with long hairy tails, and with six grinders, may be divided into two very natural subfamilies, characterized by the position and form of the cutting teeth.

The first of these groups I should propose to call *Callitrichina* : they have small erect cutting teeth, forming a regular series with the canines. This group contains the genera *Callithrix* and *Chrysothrix*, with small diurnal eyes, and *Nyctipithecius*, with large nocturnal eyes.

The second group, which may be called *Pitheciana*, have the cutting teeth large, converging together, and separated from the canines by a large space, and their under ones more or less shelving. This group contains three genera, viz. :—

1. *Pithecia*. The fur elongate, dry, harsh ; the tail club-shaped ; the crown like a wig, and the chin slightly bearded ; the lower cutting teeth rather shelving.

This is the genus *Pithecia*, as restricted by Spix, the *Yarkea* of Lesson, containing *P. monachus*, *P. leucocephalus*, and *P. rufiventer* of Geoffroy.

Spix (tab. 37. f. 4) figured a skull which appears to belong to a species of this genus, but he does not indicate its name.

2. *Brachyurus*. The fur silky, short ; tail elongate club-shaped ; the crown like a wig, and the chin largely bearded on each side ; the lower cutting teeth are rather shelving ; limb short and straight. Containing *Cebus satanas* of Hoffmannseg, which is the type of Spix's genus.

Lesson has given the name of *Chiropotes* to this group, and *Cucajao* to a second group, established on the *Simia melanocephalus* of Humboldt, which is probably only a badly stuffed specimen of this species.

Spix, in his work on Brazilian Monkeys, figures a skull which appears to belong to this genus, but it is like several others on the same plate, without any name, t. 37. f. 5.

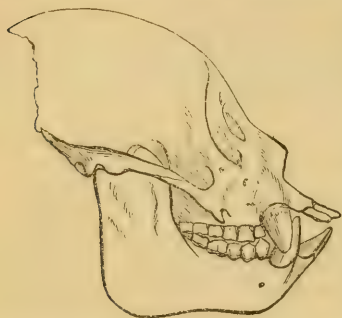
3. *Ouakaria*. The fur short, silky ; tail short, subcylindrical, the crown with short hair ; the chin scarcely bearded ; the lower cutting teeth very much shelving ; legs elongate.

This genus forms part of the genus *Brachyurus* of Spix ; and if Spix had not evidently described the teeth, &c. of his first species in

his generic character, I should have been induced to have retained for this group the name of *Brachyurus*, which is more applicable to it than to the one to which it is applied; and indeed M. Isidore Geoffroy appears to have so applied it.

Several species have been described which chiefly differ in the length of the tail; as, 1. *Ouakaria Spixii*; *Brachyurus Ouakari*, Spix, Brazil, t. 8, with the tail about one-third the length of the body. 2. *Ouakaria calvus*; *Brachyurus calvus*, I. Geoff. Rev. Cuvier. 1847, 137, much paler in colour, but it is very doubtful if the shortness of the tail does not depend on the imperfection of the specimen, and the colour on partial albinism.

We have specimens of *B. calvus* in the British Museum, presented by M. Bourcier. The skull may be thus described:—



The cutting teeth projecting; the upper one broad, especially the two middle ones; lower one elongate, narrow, more sloping, and projecting like those of *Indri*. Canines conical, far away from the cutting teeth, leaving a large vacancy; flattened in front; they are flattened before and behind, placed rather obliquely, with a sharp inner edge. The skull is very unlike that of the *Cebidæ*; most allied to that of *Pithecia leucocephala*, but the cutting teeth

in that species are not so proclined.

The converging, slender, shelving, cutting teeth in the lower jaw of this genus, as well as its slender limbs and the shortness of its tail, bear a certain resemblance to the *Indri* amongst the *Lemuridæ*.

The form of the lower jaw also offers a good character for the distinction of the genera.

1. *Lower jaw not dilated behind.*

Atelina (part).

Ateles.

Cebina.

Cebus.

Pithecia (part).

Pithecia.

Jacchina.

Jacchus.

Midas.

2. *Lower jaw dilated behind.*

Mycetina.

Mycetes (much).

Lagothrix (moderately).

Atelina (part).

Brachyteles (moderately).

Callitrichina.

Callithrix.

Chrysothrix.

Nyctipithecus.

Pithecia (part).

Brachyurus. *Ouakaria*.

2. DESCRIPTION OF A NEW SPECIES OF HERPESTES.

By J. E. GRAY, ESQ., F.R.S. ETC.

HERPESTES PUNCTULATUS.

Reddish grey, minutely black and grey punctured; face redder.

Under-fur black ; long hair brown, upper half whitish, with a broad, black, subapical band and a bay tip. Tail-end black.

Hab. South Africa ; Port Natal.

This species is allied to *H. Mutzigella* in size, appearance, and the black tip of the tail, but differs from that species in being redder, and in the face being red bay.

It agrees with *H. badius*, A. Smith, in the colour of the end of the tail ; but that species differs from it in the nearly uniform bay colour and in the length of the hair.

I may here remark, that *H. badius* offers two very distinct varieties, one being uniform red bay, the hair being of a uniform colour except a few just over the shoulder-nape which have a black subapical ring. This is the variety figured by Dr. Smith in the 'South African Zoology.' The other with most of the hairs of the back and sides having long white tips edged below with a black band, giving the back a grised appearance.

The foregoing papers were followed by an address from DR. MELVILLE, M.R.C.S., in continuation of his observations commenced on December 12, 1848, concerning the IDEAL VERTEBRA, of which he has furnished the following abstract :—

I employ the term '*vertebra*' in the extended sense in which it is used by M. Geoffroy St. Hilaire and Prof. Owen, as equivalent to a segment of the endo-skeleton, or to the proximal, more or less ossified, element of that skeleton.

The ideal or typical vertebra is the most complicated possible vertebral segment, exclusive of the ichthyic or other peculiarities ; it furnishes the key to the actual vertebræ in the same individual series or in the skeletons of the different vertebrate classes.

An actual vertebra may exist as a unity prior to, or even during chondrosis, but becomes resolved by ossification into a variable number of distinct and independent ultimate elements ; which therefore are not repetitions of one and the same elementary 'body' or 'lamina.'

The number of these ultimate elements varies in the actual vertebræ in the same spinal column, and also in those constituting the skeletons of the different vertebrate animals.

The ideal vertebra contains the greatest number of these elements, most of which form arches attached to, or springing from, a central piece or element, and protecting the great nervous and vascular axes and the visceral system.

The upper or neural arch is composed generally of three elements, two lateral, (neural laminae, or neuropomata) ; and an upper or mesial piece, (neural spine, or neuracantha), which may be subdivided in the median plane.

The inferior or hæmal arch is also constituted when most developed (tail of the lepidosiren) by three elements ; the two lateral (hæmal laminae or angiopomata) and the azygos inferior one (angiacantha or hæmal spine), which is never subdivided. This arch is most

generally present in the caudal region, disappears in the trunk, and reappears in the cervix. In man it only exists at the junction of the occipital and atlantal vertebræ, forming the so-called 'body of the atlas,' which is regarded by me as the hæmal arch of the third cranial vertebra displaced backwards to the intervertebral interspace, as in the caudal region.

The visceral arch, which is also inferior but external to the last, may be regarded as composed of an azygos inferior and two lateral elements. The former is the sternal segment and may be subdivided mesially. Each lateral piece is also resolvable generally into an upper segment (vertebral rib or pleura); and a lower one usually cartilaginous (sternal rib or hypopleura), which may be subdivided into two or three pieces (three in *Plesiosaurus*).

The segmentation of the vertebræ is partly due to the laws which preside over their genesis, and partly determined by teleological causes.

Several of the elements unite to form the vertebra of the anthropomist; thus the constituents of the neural arch coalesce with the centrum in the dorsal vertebræ; while in those of the cervical, lumbar and sacral regions, the abortive pleural complements also are anchylosed to the elements just mentioned.

In fishes, the lower part of the vertebral body is formed by the expanded bases of the angiopomata, which meet those of the neuropomata and enclose the proper centrum; but in the higher vertebrata the greater development of the centrum excludes the angiopomata from any share in the body, and displaces them backwards to the intervertebral interspace next in succession.

The coexistence of the visceral and hæmal arches is seen in fishes, in the cervical region of many lacertæ, and in the tails of the lizards and crocodiles, &c.

Therefore the one is not convertible into the other, as has been supposed by Professor Owen, who regards the sternum and sternal ribs in the thorax as the equivalents of the angiacantha and angiopomata, the latter being dislocated from their normal attachment to the centrum and suspended to the extremities of the corresponding pleural elements constituting the sternal ribs, while the former is expanded and sometimes divided mesially to form the sternum.

I am therefore compelled to suggest a new nomenclature of the elements of a typical vertebra more conformable to nature than that employed by Professor Owen, who has used the same term for several distinct objects, and given two different appellations to the one and the same element.

My view of the typical vertebra is that which has been adopted by the distinguished German anatomists Müller, Rathke, &c.

The cranial vertebræ are three in number, and may be named, from before backward, the frontal, parietal and occipital vertebræ.

The supposed nasal vertebra has no existence, the bones presumed to constitute it belonging to different categories.

Each cranial vertebra is composed of a centrum, a neural and a visceral arch; the hæmal arch is present only in the third or occipital vertebra forming the so-called 'body of the atlas.'

Between the neural arches of the cranial vertebra pass out diverticula of the cerebral vesicles to the 'sense-capsules,' as well as the ordinary cerebro-spinal sensero-motor nerves. The primary segments of the brain are three in number. The special sense nerves, and those of the cerebro-spinal system, correspond in number to the cranial vertebral segments. The auditory capsule is intercalated between the neuropomata of the second and third cranial vertebræ; the optic nerve issues between those of the first and second, while the corresponding capsule is contained in the orbital cavity, protected by certain bones, pro-orbital, meso-orbital and meta-orbital, &c.; the olfactory capsules are situated in front of the first vertebra, and are thus enabled to approximate mesially, separated only by the prolongation of the body of the frontal vertebra.

The occipital vertebra has for its centrum the basi-occipital, for its neuropomata the ali-occipital, and for its neuracantha the supra-occipital, which is sometimes divided into two.

The basi-sphenoid is the centrum of the second or parietal vertebra; the neuropomata are termed ali-parietals, and the divisions of the neuracantha parietals.

The centrum of the frontal or most anterior vertebral segment is formed by the pre-sphenoid, the neuropomata by the ali-frontal, and the divided neuracantha by the frontals.

The squamosal and mastoid bones may be regarded as belonging to the same category as the ossa Wormiana, namely, the accessory neuropomatous pieces.

The post-petrosal bone in the Chelonia is erroneously regarded by Professor Owen as the equivalent in the occipital vertebra of the angio-paral element of the body of the vertebra in fishes, or of the inferior transverse process in the higher vertebrata, since both receive the same name in his system.

The mastoid is also regarded by Prof. Owen as the 'parapophysis' of the parietal vertebra.

The visceral arch of the frontal vertebra is formed by the palato-maxillary apparatus exclusive of the pro-maxilla, and by the malleus leucus with the lower jaw in the mammalia, or by the os quadratum and Meckel's cartilage with the appendages in birds and reptiles.

The corresponding arch of the parietal is formed by the anterior horn of the hyoid bone, and that of the occipital by the posterior cornua and body of the same bone.

February 13.—William Yarrell, Esq., Vice-President, in the Chair.

The Secretary reported that a male Giraffe had been fawned in the menagerie on the previous day. The produce of the mother, who was imported in 1836, thus amounted to five males, all of whom, with one exception, were in full health and vigour.

The papers communicated were—

1. DESCRIPTION OF A NEW SPECIES OF THE GENUS *TOMIGERUS*, SPIX. BY G. B. SOWERBY, F.L.S. ETC.

TOMIGERUS PRINCIPALIS, n. sp. *Tom. testá rotundato-trigonalis*,

compressiusculâ, tenui, lævigatâ, pallescente, lineis brunneis nonnullis, per paria dispositis, cinctâ; spirâ subelatâ, anfractibus quinque, quorum duobus primis nigricantibus, tertio quartoque pallidis, brunneo-unifasciatis, ultimo magno, posticè gibbo, infra planulato; aperturâ axi parallêlâ, auriformi; peristomate latè expanso, albo, margine dextro producto, rotundato-subangulato; aperturâ intus lamellis senis instructâ, duabus in pariete aperturali, quarum posticâ compositâ, tribus in margine basali, unâ compositâ posticè furcatâ anticè bifidâ in margine dextro.

This is the largest species of this genus we remember to have seen; for which reason we have named it *T. principalis*. It is of a somewhat triangular form, rounded at the angles, and rather compressed, not being nearly so globular as the remaining three species. The substance of the shell is rather thin, it is smooth and of a pale colour with several brown transverse lines disposed in pairs; the spire is rather elevated, consisting of five volutions, of which the first and second are small and very dark-coloured, the third and fourth are pale with a brown band, and the fifth is large, and gibbose posteriorly, its anterior margin white, and it is flattish and brown anteriorly; the aperture is parallel to the axis, ear-shaped, with a broadly expanded white peristome, whose right margin is produced and forms a rounded angle; the aperture is furnished within with six lamellar teeth, two on the columellar side, of which the posterior is compound, three within the basal margin; and a single compound plate which is furcate posteriorly and bipartite anteriorly within the right hand margin. In Mr. Cuming's collection.

From Pernambuco.

2. DESCRIPTION OF TWO NEWLY DISCOVERED SPECIES OF CYCLOSTOMA. BY G. B. SOWERBY, F.L.S.

1. *CYCLOSTOMA FORMOSUM*. *Cycl. testâ suborbiculari, subdepressâ, tenuiusculâ, spiraliter striatâ, tricarinatâ, fulvo-rufescente; spirâ brevi, acuminatâ, anfractibus quinque rapidè crescentibus, rotundatis, carinis duabus validis, albicantibus castaneo-articulatis; anticè striis subobsoletis, gradatim majusculis, carinâque tertiâ umbilicem circumferente; suturâ validâ, lævi; aperturâ magnâ, ferè circulari, posticè paululùm acuminatâ, peritremate latiusculo reflexo, incisuris parvis tribus, ad carinas externas idoneis; umbilico magno, profundo, spiraliter striato, striis exterioribus gradatim majusculis.*

This very handsome *Cyclostoma* bears a general resemblance to *C. Cuvierianum*, though easily distinguishable by having three distinct keels, by having a more acuminate apex, and by the latter having the spiral striæ decussated by other sharp striæ parallel with the lines of growth. The *C. formosum* is nearly orbicular, though somewhat depressed; it is rather thin and smooth, and of a reddish fulvous or brown colour: its spire is rather short, but acuminate, consisting of five volutions which are of a roundish form and increase rapidly, and are ornamented with two keels which are of a pale colour, spotted with chestnut brown: anteriorly the striæ are rather indistinct, but

larger; and there is a thick keel surrounding the umbilicus; the suture is distinct and smooth, but belted posteriorly by the middle keel; the aperture is large, nearly circular, slightly acuminate posteriorly, with a rather broad reflected peritreme, in which are three little cuts answering to the ends of the external keels; the umbilicus is large and deep, spirally striated within; the outer striæ being the larger.

From Madagascar, in the collections of A. L. Gubba, Esq., Havre, and Mr. Cuming.

2. *CYCLOSTOMA APLUSTRE*. *Cycl. testâ suborbiculari, tenuiusculâ, lævi, albicante, fasciis nonnullis posticis, angustis, castaneis, subinterruptis, striisque tenuissimis spiralibus, ornatâ; spirâ levatiusculâ, subacuminatâ, apice obtuso; anfractibus quinque rotundatis, creberrimè transversim striatis, striis posticis fortioribus, anticis ferè obsoletis; umbilico magno, intus spiraliter striato, striis tenuissimis; aperturâ ferè circulari, posticè paululum acuminatâ, peritremate tenui, acuto, supra umbilicum paululum reflexo.*

A species somewhat resembling *C. ligatum*, but differing in several characters. It is suborbicular and thin, smooth, whitish, posteriorly with several narrow slightly interrupted chestnut-coloured bands and close-set very slender spiral striæ; the spire is rather elevated and acuminate, but the apex is obtuse: volutions five, very regularly rounded, and very finely transversely striated, the transverse striæ decussating the spiral striæ, and the posterior striæ being the most distinct, the anterior being almost undistinguishable: the umbilicus is large, very finely spirally striated within; aperture large, nearly circular, slightly acuminate posteriorly, with a thin, sharp-edged peritreme which is rather wide and slightly reflected over a part of the umbilicus.

From Madagascar, in the collection of A. L. Gubba, Esq., Havre.

3. DESCRIPTION OF A NEW SPECIES OF *BULIMUS*. BY LOVELL REEVE, F.L.S.

BULIMUS IRRORATUS. *Bul. testâ acuminato-oblongâ, medio ventricosâ, anfractibus sex, subrotundatis, striis tumidis elevatis interruptis obliquè exsculptis, infra suturas peculiariter concentricè crenulatis, columellâ strictè uniplicatâ; rufescente-purpureâ, epidermide tenui cinerascete, fulvo hic illic punctatâ, indutâ, columellâ cærulescente-albâ, labro incarnato-roseo.*

Hab. —?

This beautiful species, received by Mr. Cuming from A. L. Gubba, Esq. of Havre, is materially distinct from any hitherto described. It is of a swollen ovate form with the spire rather sharply acuminate, and the columella is distinguished by a sharp winding plate. The ground colour of the shell is a reddish purple, the last whorl being particularly characterized by a thin ash-coloured epidermis sprinkled with light fulvous spots all inclining towards the lip, which is of a delicate flesh-pink.

4. DESCRIPTION OF A NEW SPECIES OF BOX TORTOISE FROM MEXICO. BY J. E. GRAY, ESQ., F.R.S. ETC.

In a collection of reptiles recently received from Mexico are two specimens of a Box Tortoise, which, beside differing from the common box tortoise of North America, in being of a more elongated form, both agree in two characters, which are not found in that species or in any other species of the genus; first, in having an additional vertebral plate; and secondly, in the hind feet being only armed with three large claws: there is no appearance of the fourth claw, and even scarcely any rudiment of the fourth toe found in the other specimens of this genus, and in all other *Emydæ*.

This species will form a section or subdivision of the genus, which may be called *Onychotria*.

CISTUDO (ONYCHOTRIA) MEXICANA. Three-toed Box Tortoise.

Shell oblong, dark-brown, pale, spotted and rayed, spot and rays sometimes confused.

Vertebral plates with a nearly continued keel, and with a small intermediate one between the usual fourth and fifth plates.

The hinder margin acute revolute.

The head pale brown; the legs yellow or orange spotted, with five unequal claws.

The hind legs brown, uniform, with only three large claws, the middle and the front one largest.

The sternum flat; the gular plates wide in front, and suddenly narrowed behind.

Hab. Mexico.

There was a specimen of the *Kinosternon scorpiodes*, and of the Gopher, *Testudo gopher*, in the same collection: the latter only differed from the usual North American specimen in being rather larger and blacker.

February 27.—William Yarrell, Esq., Vice-President, in the Chair.

The following paper were read:—

1. DESCRIPTION OF SEVEN NEW SPECIES OF MARGINELLA.

BY JOHN S. GASKOIN.

MARGINELLA QUADRILINEATA. *Marg. testá oblongo-ovatá, pallidè virescente, nitidá; lineis rufis quatuor, equidistantibus, transversis; basi rotundatá, lævi; aperturá latá anticè præcipuè; canali latissimo; labio lato, marginato, ultra apicem extenso; columellá anticè quadriplicatá, plicis duabus anticis concurrentibus canalem intermediam formantibus; apice oblito.*

Shell oblongo-ovate, of an uniform, opaque, pale-greenish colour, highly polished, with four distinct, nearly equidistant, very narrow, uninterrupted, even, red lines or bands, surrounding the shell from the upper or outer edge of the incrassated margin of the lip, which continuing within the columella, extend over the earliest formation of whorls: these lines are equally conspicuous on the inside of the last whorl, and no doubt throughout the whole inside of the shell. The same pale-greenish colour pervades the inside as the outer part; base

round and smooth ; aperture wide, especially at the anterior portion, where the columella suddenly contracts in diameter, subspiral, curved posteriorly ; channel very broad, which and the edge of the lip are subpellucid and whitish ; at the anterior part of the columella are four prominent rather tenuous plaits : the first two conjoin and form the inner side of the channel ; the two posterior are on the columella ; between the inner side of the channel and the anterior third of the columella is a concavity ; lip thick, smooth, extends beyond the apex, no trace of crenulation, strongly margined, and the margin has its upper edge or rim of a darker colour than the shell ; it proceeds over the arch of the channel, and becomes obliterated just above the third plait ; apex imperceptible.

Long, $\frac{9.0}{100}$ of an inch ; wide, $\frac{4.5}{100}$ of an inch.

Hab. — ?

The only specimens I have seen of this species are an adult shell in the cabinet of Mr. Metcalfe, and an adult and a young one in my own ; all of which were brought to this country in H.M.S. the Samarang.

It cannot be confounded with any known species of *Marginella* ; the four narrow conspicuous red lines or bands, the two anterior plaits being a bifurcation of the inner wall of the channel, the wide aperture, and general form of the shell are ample distinctives.

MARGINELLA PUDICA. *Marg. testâ oblongo-ovatâ, albidâ, fasciis sex vel septem, transversis, continuis, pallidissimè viridi-fulvis ; maculis distinctis pallidissimè brunneis interruptis ; basi rotundatâ ; aperturâ latiusculâ ; labio crasso, marginato, ultra apicem extenso ; columellâ quinqueplicatâ ; canali lato et profundo ; margine interno labii minutè denticulato ; apice lato, obtuso.*

Shell oblong-ovate, of a white colour, having six or seven very faint greenish-brown bands traversing the shell from the border of the aperture to the upper edge of the margin, interrupted by rather large, distinct, very light-brown spots or markings ; these bands have between them broad white lines, which are the colour of the shell ; the posterior end of the shell is in an evenly projecting ridge or varix, surrounding the spire ; base round, colour of the shell ; aperture rather wide, curved (bowed) ; lip thick, extending a little beyond the apex, as described in reference to the posterior portion of the shell ; margin rather thick, and extending over the arch of the channel ; the columella is furnished with five plaits, the three anterior are prominent, especially the second, which extending over the base obliquely, forms a thickened varix ; small obtuse denticulations exist along the whole inner edge of the lip ; channel deep and wide ; apex broad and obtuse.

Long, $\frac{2.8}{100}$ of an inch ; wide, $\frac{1.8}{100}$ of an inch.

Hab. Central America.

Cab. Metcalfe, Gaskoin, Cuming.

In size, form, markings, fewer plaits, the denticulations on the inner edge of the lip, &c., separate this species from all others ; its nearest affinity may be the *Marginella tessellata*, Lam., although even that affinity is very distant ; in the size remarkably so.

MARGINELLA TRIPLICATA. *Marg. testá ovatá, ventricosá, fulvescente, lævi, nitidáque; aperturá angustá; labio tenui, inflexo, marginato; columellá anticè triplicatá; canali nullo; spirá subelatá, anfractibus distinctis, apice acutiusculo.*

Shell ovate, ventricose, of a general light fawn colour, without bands or other markings, smooth and shining; base round, aperture rather narrow; lip thin, much-inflexed, marginated; three fine white plaits are situated at the anterior portion of the columella, equidistant; the first forms the termination of the columella, the second passes very slightly on to the base, in a parallel direction to the first, the third not at all so; these plaits convey an idea as though they were differently produced to those of the generality of the *Marginellæ*; that is, in not being formed on the columella, but as though the columella had been delved in itself, leaving the lines or plaits projecting; and the semblance of a fourth plait is given by the depth and abruptness of the notch beyond the third: channel none; spire slightly prominent, with distinct whorls; apex subacute.

Long, $\frac{3.4}{100}$ of an inch; wide, $\frac{2.0}{100}$ of an inch.

Hab. The Philippines, &c.

The gibbosity and sudden tapering of this shell, the uniformity of its coloration, in having but three plaits, and those at the anterior end of the columella, and its short but perfect spire, distinguish it from any species yet described.

I had intended, on determining to describe this shell, to have retained for it the appellation by which it is so well known to many naturalists and collectors—*Marginella angystoma*, although by whom so designated I have been unable to learn, it never having before been described nor figured; but finding afterwards that M. Deshayes has described and published a fossil species found at Grignon under that name, I am obliged to forgo my wish, and have called it from perhaps a more leading characteristic—*Marginella triplicata*.

MARGINELLA SERRATA. *Marg. testá elongatá, subcylindricá, pallidá; aperturá angustá; columellá anticè quadriplicatá; labio tenui, inflexo, valdè serrato dentibus sex vel octodecim; margine crasso; spirá subelatá, anfractis distinctis, apice obtusiusculo.*

Shell elongated, subcylindrical, of a very light greyish colour, sometimes with light brown cloudings; base rather round, aperture narrow, columellar side nearly straight, with four nearly transverse equidistant plaits at the anterior portion, the first continuing to form the inner side of the channel, the second and the third passing obliquely forwards over the base, and the fourth in no degree so; lip slightly spiral, inflexed, thin, and deeply serrated at its entire edge, forming sixteen to eighteen teeth; margin thick, and continuous over the arch of the channel, and, like the lip, is of a lighter colour than the rest of the shell; spire somewhat prominent, whorls distinct; apex rather obtuse.

Long, $\frac{3.5}{100}$ of an inch; wide, $\frac{1.6}{100}$ of an inch.

Hab. The Mauritius.

Cab. Cuming.

This species approaches nearest in form to the *Marg. triticea* of Lam., but has a much narrower aperture, and the edge of the lip is strongly serrated its entire length.

MARGINELLA CONTAMINATA. *Marg. testâ oblongo-ovatâ, pallidè floris lactis colore; extus tenuissimè striatâ; aperturâ latâ, labio crasso, columellâ sexplicatâ, plicis tribus anticis prominentioribus; margine lato, planulatoque; apice prominente obtusissimo.*

Shell oblongo-ovate, of an uniform pale cream colour, without bands or markings; internally the colour is somewhat darker; external texture of the shell is finely striated: the striæ terminate anteriorly at the thickened varix over the arch of the channel curving towards the columella, and in a similar manner at the edge of the white deposit around the spire; base round, aperture wide, slightly curved; on the columella are six or more white plaits, the three anterior being rather prominent, the first continuing to form the inner side of the channel; the second forms a varix on the base of the shell; the channel broad and deep; a white deposit exists on the columella within the aperture, which widens and thickens outwardly from about the anterior fourth of the aperture, covering the plaits and proceeding over the arch of the channel, forming there a ridge or varix at its posterior edge, and diminishing in width as it approaches the lip, along the whole length of which it continues forming a broad flat margin, and terminates around the spire, which is also covered by it: apex slightly prominent, very obtuse.

Long, 1 inch; wide, $\frac{5}{10}$ of an inch.

Hab. —?

Cab. Cuming, Gaskoin.

It differs from *Marginella cornea*, Lam., in its more elongated form, the number, distribution and construction of the plaits, in its broad, flat margin, in the thinness and planeness of the lip internally, the varix at the anterior part of the base, &c.

MARGINELLA LINEATO-LABRUM. *Marg. testâ ovatâ, lavi, anfractibus posticè rotundatis, pallidè flavescente, nigro lineato-punctatâ; spirâ prominente; basi rotundatâ; aperturâ latissimâ; columellâ quadriplicatâ; labio crassiusculo, marginato, lineis octo vel novem transversis, supra labrum et marginem continuis.*

Shell ovate, smooth, the whorls even (not crenulated), of a light yellow-brown colour, having on the last whorl nine rows of distinct small black spots, or short markings, obliquely longitudinally placed, the two posterior rows of which are continuous along the whorls of the spire even to the apex; spire very prominent, whorls rather gibbous; base round; aperture very wide; the columella has four white prominent plaits, the two anterior passing obliquely outwards, the first to form the inner elevated side of the channel, the two posterior are transverse; lip, slightly bowed, is thick and marginated, and has eight or nine nearly equidistant, dark-reddish, somewhat broad lines crossing its edge and continuing over the margin; margin continuous,

but with much less thickness, over the arch of the channel, and with the first or anterior plait; channel broad and deep, obtuse.

Long, $\frac{6.0}{10.0}$ of an inch; wide, $\frac{3.0}{10.0}$ of an inch.

Hab. —?

Cab. Cuming.

The only specimen I have seen of this peculiar species is not in fine condition; when so, it must be very beautiful. It differs from *Marginella Faba*, Linn., in the evenness of the shoulders of the whorls, its less attenuated form, and the linear markings of the margin, &c.

MARGINELLA PULCHERRIMA. *Marg. testá oviformi, fulvescente, fasciis albis quinque, angustis, transversis, maculis linearibus nigris, in centros fasciarum conspicuis; interstitiis fasciâ primâ ad secundam fasciam, tertidque ad quartam, lineis plurimis tenuissimis fulvescentibus longitudinalibus notatis; aperturâ albâ, latiusculâ; columellâ quinque-plicatâ; labio tenui; apice distincto.*

Shell oviform, shining, of a light fawn colour, with five transverse, distinct, narrow, even, uninterrupted white bands surrounding the shell, from the edge of the lip, the two anterior terminating at the columellar edge of the aperture, the others proceeding inwards over the columella; the posterior is always the least distinct (conspicuous): floating, as it were, in the centre of these white bands, are very dark-brown or black, equidistant, linear markings or streaks, and similar markings in colour and form radiate obliquely on the slight ridge which encircles the spire: the spaces of the shell between the anterior band and the second, and between the third and the fourth, are occupied by numerous, fine, longitudinal and parallel light-brown lines, the other spaces between the bands are irregularly marked with the same colouring, varying in individual specimens, in intensity of coloration, especially in the middle space (that between the third and the fourth bands); base round; aperture white, rather wide, flexuous posteriorly; five plaits on the columella; the three anterior project; the first is continuous with the inner side of the channel, the second takes a similar direction behind it, passing obliquely over the base of the shell, and next this is a white varix following outside the aperture a similar direction, on which are four or five dark-brown spots; lip thin, no margin; apex perceptible.

Long, $\frac{2.0}{10.0}$ of an inch; wide, $\frac{1.4}{10.0}$ of an inch.

Hab. West Indies.

Cab. British Museum, Metcalfe, Gaskoin, &c.

Differs from the *Voluta catenata* of Montagu* (*Marginella* of others) in having but four distinct, and one rather obscure, bands; in these being uninterrupted, and the linear markings floating in their centres, and not linking interrupted or disjointed portions of the bands, as in *M. catenata*; in the dark colour, and the more oviform shape. I have hitherto found this species among parcels of *Marginella sagittata* of Hinds.

* Which I believe to be a West Indian production only, and not as Montagu was led to suppose, a British species. I have found the *Marginella catenata* frequently among the small West Indian *Marginellæ*, as have many others, and from no other source did Montagu himself obtain it.

IPSWICH MUSEUM.

On Thursday the 13th December was celebrated the second Anniversary of this very promising Institution. By half-past twelve there was a very numerous and respectable assemblage, when the Rev. Samuel Hinds, D.D., Lord Bishop of Norwich, entered, accompanied by the Rev. Robert Eden, M.A., F.S.A., his Lordship's Chaplain, the Revds. the Professors Sedgwick and Henslow, the Rev. E. Sidney, the Hon. and Rev. F. De Grey, the Rev. A. B. Power, the following Fellows of the Linneæan, Geological, Astronomical and Zoological Societies, Mr. G. Ransome, Mr. May, Mr. John Gould, Mr. Richard Taylor, Capt. Ibbetson, Mr. G. Waterhouse, Mr. J. S. Bowerbank, Mr. L. Reeve and other gentlemen, several of whom were most hospitably entertained during their stay in Ipswich by G. Ransome, Esq., and C. May, Esq.

The Bishop of Norwich having taken the chair addressed the meeting as follows:—Mr. Kirby, the time-honoured President of this Institution, being unable to attend as usual, it has fallen to my lot to occupy the chair. Before entering on the business of the day, however, permit me to express the great gratification I feel at the opportunity which this meeting has afforded me of introducing myself to some sort of acquaintance with a great number of those among whom my lot is now cast, and whose welfare it will be my duty henceforward, as well as, I assure you, my earnest desire, to promote in every possible way. I may be permitted to express, at the same time, my sympathy with the sadder feeling which, no doubt, my occupancy of this chair today will have awakened in the minds of many, who remember their connection with one who is now no more; one who was not only a zealous friend of the Ipswich Museum, but an ardent supporter and patron of every enterprise which had for its object the intellectual advancement and the moral elevation of his fellow-men. I regret that my habits and pursuits but ill qualify me to contribute to this meeting the enlivening anecdote and the interesting information which he, on these occasions, always had at command, from the stores of his own observation, and from his researches in a particular branch of Natural History; but I wish to assure you that I am not the less alive to the value of this Museum and of Museum meetings, especially a Museum which is the resort and the property of the humbler classes, of the artisan, the mechanic, the mere day working man. That I believe is the distinctive feature of this Institution. I know of no other characterized in the same manner. Now, I conceive this to be a very interesting point of view. No question, perhaps, at this moment, is more important, socially and morally, than the question, how the humbler classes of our brethren, those who have to earn their daily bread by the sweat of their brow,—how they are to employ their little leisure time, so as at once to make it available for the relaxation and recreation that are necessary for them, and, at the same time, to be improving themselves? A museum appears to me to combine the two objects most excellently; it is amusing and it is instructive. The objects which they find in the Museum, together with the instruction which they derive from

other sources here, constitute a knowledge which comes across them in their daily avocations: things which cross their path in the field, or in their workshop, and which would never otherwise, perhaps, have been so much as observed, now become the means of interest, of instruction, and of improvement to them. The Museum is in this manner, I should say, to them the acquirement of a new faculty, of a new power; and I cannot but hope and believe, although the Institution has been in existence but two years, that the result has been altogether satisfactory, and even beyond what could have been expected from it. I shall not detain the meeting longer from so much that is valuable and interesting, to which we are looking forward, and I shall, therefore, at once call upon Mr. Ransome to read the Report.

George Ransome, Esq., then read the Report, containing a view of the objects and progress of the Institution, from which we give the following passage:—

“And how, it may be asked, does the Institution intend to accomplish these purposes? or how does it tend to advance the education of the people? If any presume that we merely gratify an idle curiosity, we answer that we have evidence to assure us that we not only very greatly increase the gleaners of knowledge, but that we add to the number of the real cultivators and reapers in the fields of science, and especially in the various departments of Natural History. We lay the foundation of future inquiry; we awaken the mind. From the advantages afforded them in the Museum, by the sight of specimens, by lectures and classes, the visitors become admirers; the admirers, students; the students, collectors; the collectors, donors, presenting specimens, and adding their ideas to the parent stock. Such is the assistance we have received, and are continually receiving, not only from our home friends, but from those who visit foreign lands.”

A tribute of well-merited gratitude and respect was then paid to the memory of Dr. Stanley, the late bishop of the diocese, and the lamented President of the Linnæan Society.

“We have now a melancholy part of our Report to dwell upon, the loss by death of Dr. Stanley, the late Bishop of Norwich, an early friend and a generous patron of the Museum. Its design and object were peculiarly dear to him; he was a warm advocate in its behalf—he was greatly instrumental in promoting its success. He gave us the right hand of fellowship, and advanced our interests to the utmost of his power. We owe him a lasting debt of gratitude, and his bust and faithful portrait will long continue to associate his name and memory with an Institution which he admired, loved and cherished.”

The Rev. Professors Sedgwick and Henslow, and the Rev. E. Sidney, also dwelt upon the many excellences of Dr. Stanley in terms of the most affectionate remembrance. Several gentlemen having addressed the meeting, Mr. Ransome proposed the names of the Rev. M. J. Berkeley, the eminent cryptogamic botanist, G. Waterhouse, Esq., and Dr. A. B. Garrod, as Honorary Members. Mr. R. Ransome rejoiced in common with the company present at the success of the Institution; thus far it had eminently prospered. The working classes had shown their esteem for it by the extraordinary amount of their visits, and that, too, without one single instance of

either disorderly conduct or damage to anything in the Museum. He hailed the circumstance of the Bishop coming forward to walk in the steps of his highly respected predecessor, as an omen for the future success of the Institution.

The Bishop of Norwich was much obliged to the meeting for the kind compliment, and for the hearty welcome which he had found in Ipswich. In supporting that Institution, in giving it what encouragement and countenance were in his power, in treading in the footsteps of his lamented and honoured predecessor, he felt that he was doing no more than a bare duty, for he could not but recollect that the Museum was a Museum for the people. He could not but congratulate the meeting on the result of what had taken place that day. These meetings were a most important arrangement in conjunction with the Museum itself; he might say that they gave life to the dead specimens with which they were surrounded.

The Dinner, which was numerously attended, was presided over by J. C. Cobbold, Esq., M.P. for Ipswich, supported by H. E. Adair, Esq., M.P., A. S. Adair, Esq., M.P., and J. H. Harcastle, Esq., M.P.; the Bishop of Norwich, and many of the Clergy. His Lordship, in responding to a toast from the chair, remarked that it was quite true, as the Chairman had observed, that this was the first occasion upon which he had been called to respond to the toast of "The Bishop and Clergy of the Diocese." It was peculiarly gratifying to him that the first occasion of his doing so should be at a meeting of this particular description. It was a token of an improved and enlightened spirit of the age. The time, he hoped, was now quite gone by, when scientific and natural truth was considered not only at variance with, and distinct from, religious truth, but principally in opposition to it. As Professor Sedgwick had very forcibly pointed out that morning, the Word and Works of God were only books which we must trace to the same Divine authorship—different volumes of a revelation of mercy; and he was persuaded, that the more they compared the one with the other, in an honest and right spirit, the more He would enable us to illustrate and confirm the one by the other. The Museum and its meetings had a direct connection with the ministry; for an Institution which tended obviously to withdraw the humbler classes from debasing scenes and habits, and which rendered these classes industrious, sober, and honest, was an Institution that was co-operating with the ministrations of the clergy; to a certain extent it occupied the same ground, that was to say, it prepared the objects of their ministrations for the more ready application of the Divine word.—A meeting like the present was common ground for all. Whatever might be our differences or disagreements on politics or on religion, here, at least, we were united—we were one. The Museum, and its meetings, which were very important adjuncts, furnished us with the materials of a temple of charity.

On the previous Wednesday evening a highly interesting lecture had been delivered by Professor Owen upon the extinct gigantic wingless birds of New Zealand, which we hope to notice in a future number.

MISCELLANEOUS.

BOTANICAL NOTES.

Odontites verna, Reich., and its allies.—In the course of a very short tour in the eastern Pyrenees during the past autumn, I did not fail to observe the forms of this group which happened to come in my way, especially with a view to distinguish the plant which I have described in a recent number of this Journal as *O. Bertolonii*; I failed however to find any forms which should not be referred to *O. verna*. The state of the latter plant which I found abundantly in cultivated land in the mountainous region of northern Catalonia, has larger fruit than it is usually found to possess, but the form of the capsule and calyx-segments is quite normal, and does not approach to my *O. rotundata*. I have recently received from M. Jordan of Lyons specimens of three forms of this group detected by that accurate observer in the neighbourhood of Lyons, and named by him respectively *Euphrasia verna*, Bell., *E. serotina*, Lam., and *E. divergens*, Jordan. The first of these agrees with the common European *Odontites verna*; the second is the more slender plant which I have distinguished as var. *elegans*, and which is not in my opinion specifically distinct; the third is a plant with which I was not previously acquainted, and which appears to have strong claims to rank as a distinct species. In habit, and in the size and form of the capsule, it resembles *O. Bertolonii*, but the leaves, instead of being ovate and distinctly toothed, are almost linear, with one or two scarcely perceptible teeth, those of the branches being usually entire; the calyx-segments are short (one-third of its length) and triangular, as in *O. rotundata*, and M. Jordan observes that they are adpressed to the ripe capsule, which is not the case in the common species. This latter character it is difficult to verify in dried specimens, but it appears to be likewise characteristic of *O. rotundata*. The flowers are too imperfect for description in M. Jordan's specimens of *O. divergens*, but they appear to be much smaller than in the other allied species.

Rhinanthus major and *R. angustifolius*.—In the tenth volume of DeCandolle's 'Prodromus,' Mr. Bentham enumerates England amongst the native localities of both the above-named species of *Rhinanthus*, although the former alone has hitherto been enumerated as a British plant. If, as Mr. Bentham seems to consider, the character derived from the presence or absence of a membranous edge to the seeds be not trustworthy, it is difficult to assign any more constant character by which to distinguish these species; but such has not been the result of my observations, so far as they have extended. I shall briefly note the forms with which I am acquainted:—

R. major, Ehrh.?, Benth. in DeC. Prod. Hairy calyces and broadly winged seeds. France, Switzerland, Italy, Germany and Hungary. (J. B. spec. in herb.).

R. major, *β. alpina*, Benth. Calyces nearly or quite glabrous, segments more acute, broadly winged seeds. Alps, Apennines, Riesengebirge, and Carpathians. (J. B. spec. in herb.).

A specimen without ripe fruit from the herbarium of the late Pro-

fessor Graham, marked 'Durham, 1836,' seems to me to agree with this form, but I have not seen any undoubted English specimens.

R. angustifolius, Gmel. Calyces glabrous, with acute segments, leaves very narrow, seeds nearly or quite wingless. Scotland (Fort George, Professor Balfour; corn-fields in Nairn, Mr. Stables).

This plant appears to me to be rare on the continent of Europe. I have found it near Cracow; but though Mr. Benthams says, "in Europæ mediæ et præsertim australioris pascuis," I have never seen specimens from the south of Europe. It is true that if the character derived from the seeds be not permanent, it is very difficult to distinguish this from *R. major*, β . *alpina*, Benth., as the latter plant has frequently very narrow leaves; but as I have already observed, I am not able to confirm the asserted variableness of the form of the seeds, which are constantly winged in all the specimens of *R. major* which I have examined.

It may be suspected that two other described species, *R. buccalis*, Wallr., and *R. Reichenbachii*, Drejer, constitute between them a variety of *R. angustifolius*, having the same relation to that plant that the common European *R. major* has to the variety β . *alpina* of Benthams.

J. BALL.

ECHINORHINUS SPINOSUS.

Falmouth, Dec. 7, 1849.

SIR,—I send a short description of a splendid specimen of the "*Echinorhinus spinosus*," Blainv., caught yesterday a few miles from the harbour by one of Mrs. Chard's trawl-boats—for your Journal, should you consider it worth insertion.

I am, Sir, your obedient servant,

R. Taylor, Esq.

W. P. COCKS.

Description.—Head depressed; eyes bright, copperish; nose obtuse; mouth large; teeth in both jaws broad and low, the edge nearly horizontal. Body thick, 2 feet in depth and 7 in length (from snout to commencement of caudal fin); pectoral fins small, truncated; dorsal two, placed very far back, opposite to abdominal fins.

Surface of skin polished and covered with strong bony spines of various sizes and heights, arising from circular bases from $\frac{1}{8}$ th to $\frac{1}{4}$ ths of an inch in diameter.

Colour.—Back and sides dark leaden gray; abdomen, throat, &c., dirty yellowish white, clouded all over with light gray and brown; base of fins brownish.

A white line extended from the base of the pectoral fins to commencement of the caudal. Five large branchial apertures.

It weighed more than 200 lbs.

On the Presence of Entophyta in healthy living Animals.

By Dr. LEIDY.

From the opinion so frequently expressed, that contagious diseases and some others might have their origin and reproductive character through the agency of cryptogamic spores, which, from their minuteness and lightness, are so easily conveyed from place to place through

the atmosphere by means of the gentlest zephyr, or even the evaporation continually taking place from the earth's surface; and from the numerous facts already presented of the presence of cryptogamic vegetation in many cutaneous diseases and upon other diseased surfaces, I was led to reflect upon the possibility of plants of this description existing in healthy animals, as a natural condition; or, at least, apparently so, as in the case of entozoa. Upon considering that the conditions essential to vegetable growth were the same as those indispensable to animal life, I felt convinced that entophyta would be found in healthy living animals, as well, and probably as frequently, as entozoa. The constant presence of mycodermatoid filaments growing upon the human teeth, the teeth of the ox, sheep, pig, &c., favoured this idea, and accordingly I instituted a course of investigations, which led to the discovery of several well-characterized forms of vegetable growth, of which, at present, I will give but a short description, for the purpose of establishing priority, and propose giving a more detailed account of them, with figures, on some future occasion.

Enterobrus, a new genus of *Confervaceæ*. Simple, attached, isolated filaments consisting of a long cylindrical cell, (containing protoplasma, granules, and large translucent globules enveloped in a primordial utricle,) with a distinct coriaceous peduncle or stipe of attachment, and at length producing at the free extremity one or two, rarely three, shorter cylindrical cells (filled with the same matter as the parent cell).

Enterobrus elegans. Filaments olive-brown, brownish yellowish, or colourless, at first forming a single spiral turn, and then passing in a straight or gently curved line to the free extremity. Peduncle, or stipe of attachment, adhering very firmly, coriaceous, uniformly brownish, narrower than the frond-cell, papillary, columnar, elongated conical or pyramidal, expanded at base and at point of attachment to frond-cell, marked with longitudinal lines, and frequently with transverse annular constrictions, with no definite interior structure. Length from 1-3750th to 1-400th of an inch; breadth 1-3200th to 1-1666th. Frond-cell much elongated, frequently reaching the length of 2 or 3 lines, uniformly cylindrical, excepting at free extremity, where it is usually clavate; breadth in full-grown individuals pretty uniformly 1-935th of an inch. Contents consisting of a colourless protoplasma, with more or less numerous, fine, translucent, yellowish or colourless granules, measuring about 1-15,000th of an inch, and numerous large, colourless, transparent globules or vesicles filled with fluid, averaging the 1-2870th of an inch in diameter. End-cells only existing in full-grown individuals, one, usually two, rarely three in number; the first one cylindrical, 1-86th of an inch in length by 1-1000th in breadth, filled with more granules and less globules than the parent cell; end-cell clavate, 1-135th of an inch long by 1-750th broad, at the clavate end 1-638th, filled with granular matter and a few globules.

Length of full-grown individual 2 to 3, sometimes 4 lines.

Hab. Grows from the basement membrane of the mucous mem-

brane of the small intestine of *Julus marginatus*, Say, occasionally from the same membrane at the commencement of the large intestine, and also from any part of the exterior surface of *Ascaris infecta* and *Aorurus*; entozoa infesting those portions of the intestinal canal of this animal.

The youngest individuals of *Enterobrus* which I ever detected, measured 1-380th of an inch in length by 1-1060th in breadth, but the most usual sizes vary from the 1-150th of an inch to the full-grown individual. At all ages they contain the same character of contents, but in the younger ones the large globules are usually predominant, sometimes to such an extent as to exclude the other matters. When quite young they are usually more or less clavate and straight; a little more advanced they form a gentle curve, about one-eighth of a circle. A little older, the distal half or third becomes uniformly dilated, and forms an obtuse angle with the other portion; after this, as it continues growing, it usually forms a single spiral turn, becomes uniformly dilated, and thus advances to the full-grown individual. The cell-contents consist principally of large transparent globules, with granules and protoplasm in the interstices. Frequently the cells are found distended with the globules to such an extent that the other matters almost, and occasionally even entirely disappear. Iodine turns the protoplasm and granules deep yellow or very deep brown, and causes the rupture of the globules, when a clear fluid is observed to exude; very slightly coloured purplish, or undergoing no change of colour from the iodine. Solution of iodine, acetic acid, salt water, or the prolonged action of water alone, causes a contraction of the cell-contents from the sides of the permanent cell-wall, but they are still held together by an apparent delicate membrane of the character of a primordial utricle. Frequently in dead individuals, the interior contents shrink to two-thirds, occasionally to one-third the diameter of the cell calibre, and almost eight to twenty times the diameter of the cell from each extremity, when they have the appearance of a shrivelled granular membrane. In these latter cases the characteristic globules and granules have disappeared, and their place is more or less occupied with water, and yellowish globular, highly refractive bodies, which resemble oil. These latter globules vary in size from a mere point up to one-fourth the diameter of the cell. The smaller ones are contained within the shrivelled primordial utricle with a few of the larger ones, and a number of the latter occupy a position between the primordial utricle and the cell-wall, apparently formed by a conjunction of the smaller globules and an exudation through the primordial utricle during the act of contraction consequent upon decomposition. They are insoluble in alcohol, but are soluble in æther and solution of potassa; in fact in all their properties they resemble oil. Can these oil globules be the result of decomposition?

The protoplasm or fluid of the cells is colourless or faintly yellowish, contracts or coagulates upon the application of alcohol, and is coloured brown by iodine, having all the characters usually possessed by that albuminoid fluid found in all young vegetable cells, and denominated protoplasm by H. von Mohl.

The clear granules are minute, yellowish, and resemble fine oil globules. They are turned deep brown by the action of iodine.

The clear globules appear to consist of a delicate vesicular membrane probably derived from the primordial utricle, filled with a colourless fluid.

No circulatory or other movement, as in *Achyla prolifera*, exists in the cell-contents. The end-cells of the full-grown individuals are usually two in number, and much shorter than the parent cell. Occasionally I have found three end-cells, more frequently but one. These cells are formed from the parent cells by a contraction first taking place in the contents with the primordial utricle, a partition from the permanent cell-wall forming afterwards.

The end-cells are probably spore-cases; their contents are usually a dense mass of fine granules, similar to those of the parent cell, with a few intermingled globules. I never saw any movement, molecular or other, in the contained matter, except during decomposition.

A question may arise as to the true situation of this plant among the Cryptogamia. I have placed it in the order *Conferraceæ*, from the diagnosis given by Endlicher in his 'Genera Plantarum': "*Fila capillaria, membranacea v. filamentosa, intus v. extus articulata, simplicia v. ramosa, libera (i. e. haud in frondem coalita), interdum tamen reticulatim contexta, viridia v. rarius fusca aut purpurea, in formis infimis hyalina,*" &c.

Cladophytum, a new genus of *Entophyta* allied to the *Mycodermata*. Filaments minute, attached by means of a roundish nucleus, simple, or compounded near the base of attachment, with minute lateral ramuli, inarticulate, and with no evidence of interior structure.

Cladophytum comatum. Filaments delicate, regular, colourless, simple, more frequently branched near the base at very acute angles, growing in more or less dense bunches from a yellowish rounded or oval, attached, nuclear body varying in size from 1-7500th to 1-600th of an inch. Lateral ramuli very minute, measuring in length from 1-15,000th to 1-3000th of an inch, and passing off at acute angles. No indication of articulation or interior structure.

Length from 1-666th to 1-120th of an inch.

Hab. Growing more or less profusely from the mucous membrane of the small intestine of *Julus marginatus*, occasionally from the same surface at the commencement of the large intestine, from any part of the exterior surface of entozoa infesting those cavities, and also from any part of the surface of *Enterobrus elegans*.

Arthromitus, a second new genus of *Entophyta* allied to the *Mycodermata*. Filaments always simple, cylindric, articulated, without ramuli, attached by means of a nuclear body, and with no evidence of interior structure.

Arthromitus cristatus. Filaments delicate, straight or inflected, growing in tufts usually of moderate density, from minute, attached, yellowish, rounded or oval nuclear bodies. Articuli short, cylindric, uniform, measuring 1-9090th in. in length by 1-15,000th in breadth, with no traces of interior structure.

Length 1-375th to 1-46th of an inch; breadth 1-15,000th in.

Hab. Same as *Cladophytum comatum*, but rarely growing in such dense tufts.

The three genera of Entophyta of which I have now spoken, are all so constantly found in the *Julus marginatus*, that I look upon it as a natural condition, and should I hereafter meet with an individual without them, I will consider it a rare exception, because, in one hundred and sixteen individuals which I have examined during the past thirteen months, in all seasons, and at all ages and sizes of from one up to three inches of the animal, I have invariably found them. It cannot be supposed that these are developed and grow after death, because I found them always immediately upon killing the animal. Whilst the legs of fragments of the animals were yet moving upon my table, or one-half of the body even walking, I have frequently been examining the plants growing upon part of the intestinal canal of the same individual. And upon the entozoa, these entophyta will be frequently found growing, whilst the former are actively moving about. I found among others an *Ascaris* three lines long, which had no less than twenty-three individuals of *Enterobrus*, averaging a line in length, besides a quantity of the other two genera growing upon it, and yet it moved about in so lively a manner that it did not appear the least incommoded by its load of vegetation. This specimen I have preserved in a glass cell in Goadby's solution, and exhibit it to the Academy.

The animals were uniformly enjoying good health, *i. e.* all the organic and animal functions were natural; they eat, grew, reached their definite size, reproduced, and, in fact, presented all those actions characteristic of the normal state of existence of the animal.

The genus *Julus* is an extensive one, and its species are found in all the great parts of the globe, and as their habits are the same, the conditions for the production of the entophyta will be the same; and I think I do not go too far when I say, they will be constantly found throughout the genus in any part of the world, so that naturalists and others may, upon examination, readily verify or contradict the statements which I have this evening presented.

From these facts we perceive that we may have entophyta in luxurious growth within living animals, without affecting their health, which is further supported by my having detected mycodermatoid filaments in the cæcum of six young and healthy rats, examined immediately after death, although they existed in no other part of the body. These filaments were minute, simple and inarticulate, measuring from 1-5000th to 1-1428th in. in length, by 1-16,000th of an inch in breadth. With them were also found two species of *Vibrio*.

Even those moving filamentary bodies belonging to the genus *Vibrio*, I am inclined to think, are of the character of algous vegetation. Their movement is no objection to this opinion, for much higher confervæ, as the *Oscillatoria*, are endowed with inherent power of movement not very unlike that of the *Vibrio*, and indeed the movement of the latter appears to belong only to one stage of its existence. Thus, in the toad (*Bufo americanus*), in the stomach and small intestine, there exist simple, delicate, filamentary bodies, which are of

three different kinds. One is exceedingly minute, forms a single spiral, is endowed with a power of rapid movement, and appears to be the *Spirillum undula* of Ehrenberg; the second is an exceedingly minute, straight and short filament, with a movement actively molecular in character, and is probably the *Vibrio lineola* of the same author; the third consists of straight, motionless filaments, measuring 1-1125th in. long, by 1-15,000th broad; some were however twice, or even thrice this length, but then I could always detect one or two articulations, and these, in all their characters, excepting want of movement, resemble the *Vibrio*. In the rectum of the same animal the same filamentary bodies are found, with myriads of *Bodo intestinalis*; but the third species, or longest of the filamentary bodies, have increased immensely in numbers, and now possess the movement peculiar to the *Vibrio lineola*, which however does not appear to be voluntary, but reactionary; they bend and pursue a straight course, until they meet with some obstacle, when they instantly move in the opposite direction, either extremity forward.

But it must not be understood that these facts militate against the hypothesis of the production of contagious diseases through the agency of Cryptogamia. It is as well established that there are microscopic Cryptogamia capable of producing and transmitting disease, as in the case of the Muscardine, &c., as that there are innocuous and poisonous fungi. But to suppose that they are the sole cause of contagious disease, is to doubt the possibility of other causes, such as a change in the chemical constitution of the atmosphere, the elements of our food, &c., and is as ridiculous as the psoric origin of most diseases of that miserable charlatantry denominated homœopathy. In many instances it is difficult to distinguish their character whether as cause or effect, as upon diseased surfaces, in *Tinea capitis*, aphthous ulcers, &c. In a post-mortem examination in which I assisted Dr. Horner, a few weeks since, twenty-eight hours after death, in moderately cool weather, we found the stomach in a much softened condition. In the mucus of the stomach I detected myriads of mycodermatoid filaments, resembling those growing upon the teeth; simple, floating, inarticulate, and measuring from 1-7000th to 1-520th of an inch in length, by 1-25,000th of an inch in breadth. It is possible they may have been the cause of the softened condition; but I would prefer thinking that swallowed mycodermatoid filaments from the teeth, finding an excellent nidus in the softening stomach, rapidly grew and reproduced themselves. In the healthy human stomach these do not exist.

In the stomach of a diabetic patient, I found so very few that they probably did not grow there, but were swallowed in the saliva.

Dr. Leidy afterwards exhibited numerous drawings of the entophyta described by him, and also specimens, beneath the microscope, growing from the mucous membrane of the small intestine of *Julus*, and from the exterior surface of entozoa infesting that cavity.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 225.

DESCRIPTION OF A NEW SPECIES OF PARROT.

BY G. R. GRAY, FSQ., F.L.S. ETC.

PSITTACUS RÜPPELLII.

Uniform dark bronze colour, with the lesser and under wing-coverts bright yellow; the feathers of the thighs orange-yellow.

Total length 9 inches 6 lines; bill, from gape, 10 lines; wings 5 inches 6 lines; tail 3 inches 3 lines; tarsi 6 lines.

The greater uniformity of colour at once distinguishes it from the allied species, *Psittacus Meyeri* and *P. rufiventris* of Dr. Rüppell.

The specimen from which this description is taken lived for upwards of twelve months in the Society's collection, and is believed to have been brought to this country from the river Nunez. I have named it in honour of my distinguished friend, whose labours have contributed so largely to our knowledge of African zoology.—*From the Proceedings of the Zoological Society.*

ON DECAY IN FRUIT.

Even the meanest subjects afford matter for admiration when attentively observed. Nothing at first sight could appear less interesting than the mode in which decay takes place in fruit; yet several distinct phænomena are exhibited, even in the same individual variety. In Apples, for instance, every housewife has observed that her fruit sometimes rapidly passes into a moist loathsome mass, while at other times it becomes a brown or black mummy. In the former case either some *Penicillium* or *Mucor* is almost invariably present; in the latter there is sometimes a fungus of a totally different type, though frequently there is no indication, at least externally, of any parasite.

An appearance, so very strange, presented itself a few days since in a basket of common Codlins, that a specimen was at once brought to us for examination. The whole of the outer surface had assumed a pale gray opaque tinge, as if it had been scalded, the substance meanwhile feeling extremely hard and glassy, reminding one forcibly of the potatoes described by Martius affected with the dry rot (*Trockenfäule*). Here and there beneath the cuticle beautiful radiating threads were observed, evidently indicating the presence of a fungus, but as they did not proceed to any further development, we could not ascertain of what species they were the mycelium. The gray tinge soon assumed, in portions of the surface, a deep brown tint, though the greater part still remained pale. A section exhibited three different strata, the central one apparently sound, but rapidly becoming reddish brown, and collapsing in a very different way from what would have been the case with healthy tissue; surrounding this was a thin layer of brown, evidently diseased, if not actually dead cells, and beyond this a superficial stratum of pale gray tissue. In none of these was there any trace of fungus threads except where the radiating flocci, above mentioned, were visible; the brown cells had lost their granular contents, and the walls of the gray cells were very irregular and collapsed, so as to present a confused appearance

under the microscope. After exposure to the air for two days, a crop of fungi appeared on the cut surface; but, strange to say, the central portion, consisting of the two internal strata, was covered with a species of *Oidium* of a grayish tint, while the external ring, which had now lost all rigidity, was occupied with a white circle of *Penicillium glaucum* passing on the inner edge into the greenish tinge of adult tufts of that fungus. We do not recollect to have seen anything of the kind before, and we record it with the greater pleasure, as it shows how much ground there is for observation, even in objects which we tread every day under foot.

The *Oidium* is a most beautiful object under the microscope. It is a form of *Oidium fructigenum*, differing merely in its rather grayer tinge and diffuse mode of growth, owing probably to its having liberty of free development, instead of being forced to break out through the cuticle, in which it forms little tufts which are often arranged concentrically. In intimate structure it precisely resembles the type which is admirably figured by Corda in his '*Icones Fungorum*.'—*Gardeners' Chronicle*.

PRESIDENCY OF THE LINNÆAN SOCIETY.

The anonymous writer of the paragraph in the '*Athenæum*,' in which it was asserted that there was "a strong feeling among the Fellows" of the Linnæan Society "in favour of biennial election to the Presidency," is, of course, very angry at the notice on the subject in the last Number of the '*Annals*.'

In a paragraph (*Athenæum*, Dec. 8) the writer attempts to elude the charge of having made a false statement. The expression, "a strong feeling among the Fellows," must evidently have been intended to convey that such feeling prevailed among the majority, or at least some considerable number of the Fellows: and this, we again assert, is wholly without foundation. "WE stated," says the writer, "what WE knew to be the fact, that *many* of the Fellows inclined towards a biennial election." Who, then, is this wonderful WE, that pretends to know so much of the feelings and opinions of the Fellows of the Linnæan Society? And what does he call *many*? ten, five, or two? Or perhaps he considers his WE a host in itself. If however he would append his initials, which (to use his own phrase) "have not yet transpired," and which probably might be deciphered as easily as our R. T., the public might be enabled to judge of the value of his statements. The right of the author of the paragraph to entertain any opinion he pleases was never questioned (although he falsely charges us with assuming "that no opinion differing from our own can be held"); nor did we enter at all upon the question as to a biennial election; what we protested against was, that he should obtrude his private fancies upon the public, pretending that they were the strong feeling of a large body of Fellows. We also object that recourse should have been had to the hackneyed newspaper expedient for setting an unfounded rumour afloat by such an insinuation as the following:—"It has *not yet transpired* whether the invitation *has or has not been received conditionally* by Mr.

Brown"—thus pretending to assume either that it was in contemplation to propose to him to accept the Presidency on some conditions different from those of the Charter, or that he himself desired to do so : whereas the writer, if he has the acquaintance with the affairs of the Society to which he pretends, must have been perfectly aware that no such question had ever been broached.—R. T.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1849.

Chiswick.—November 1. Fine. 2. Foggy: very fine. 3. Dense fog. 4. Foggy: cloudy at night. 5. Cloudless and fine. 6. Clear. 7. Rain. 8. Densely overcast. 9. Overcast: fine: overcast. 10. Exceedingly fine. 11. Clear and fine: foggy at night. 12. Foggy: hazy. 13. Fine: rain. 14. Heavy rain: clear at night. 15. Clear: cloudy: clear. 16. Fine. 17. Clear. 18. Overcast: slight rain: showery at night. 19. Hazy. 20. Uniformly overcast. 21. Hazy. 22. Foggy: overcast. 23. Overcast: rain. 24. Foggy. 25. Foggy: cloudy: clear. 26. Foggy: cloudy and cold: clear: sharp frost at night. 27. Sharp frost: clear: foggy. 28. Frosty and foggy: clear and frosty: foggy. 29. Overcast: fine: overcast. 30. Constant rain.

Mean temperature of the month	41° 99
Mean temperature of Nov. 1848	41 °18
Mean temperature of Nov. for the last twenty-three years	43 °41
Average amount of rain in November	2·56 inches.

Boston.—Nov. 1. Cloudy. 2. Fine. 3, 4. Foggy. 5, 6. Fine. 7. Cloudy: rain A.M. and P.M. 8—10. Cloudy. 11. Fine. 12. Foggy. 13—17. Fine. 18. Cloudy: rain A.M. 19, 20. Fine. 21, 22. Cloudy. 23. Cloudy: rain P.M. 24—26. Fine. 27. Fine: snow A.M. 28. Snow. 29. Cloudy. 30. Rain: rain A.M.

The following are the averages for Oct. 1849, with which we have been favoured by our correspondent Mr. W. Veall of Boston, whose report did not arrive in time for our last Number.

Barometer.	Thermometer.	Rain in inches.
29·46	48·8	3·32

Applegarth Manse, Dumfries-shire.—Nov. 1. Rain during night: cleared P.M. 2. Raw frost A.M.: rain: fog P.M. 3. Raw frost again: threatening rain. 4. Fine A.M.: rain and high wind P.M. 5. Heavy showers all day. 6. Hard frost A.M.: storm of snow P.M. 7. Frost: snow nearly all day. 8—10. Slight drizzle: damp all day. 11. Heavy rain and thick. 12. Dull A.M.: fine noon: wet P.M. 13. Heavy showers, with blasts. 14. Clear and cold, with showers. 15, 16. Frost: clear and fine. 17. Close rain and mist all day. 18. Rain during night: mild: rain. 19. Rain during night: cleared: warm. 20. Rain and fog all day. 21. Fair, but dull. 22. Rain and fog throughout. 23. Rain and fog: cleared P.M. 24. Frost, hard: grew mild. 25. Frost not so hard: rain: fog. 26. Frost hard again. 27. Frost hard all day. 28. Frost very hard. 29. Snow: hard frost: rain P.M. 30. Thick fog: heavy rain: cleared.

Mean temperature of the month	42° 0
Mean temperature of Nov. 1848	39 °8
Mean temperature of Nov. for the last twenty-five years ...	40 °4
Mean rain in November for twenty years	3·60 inches.

Sandwick Manse, Orkney.—Nov. 1. Fine: large halo: aurora. 2. Showers. 3. Fine: showers. 4. Cloudy: showers. 5. Showers. 6, 7. Snow: snow-showers. 8. Snow-showers: rain. 9. Cloudy. 10. Showers. 11. Bright: cloudy: aurora. 12. Bright: clear: aurora. 13. Showers: aurora. 14. Bright: clear: aurora. 15. Bright: frost: showers. 16. Clear: frost: clear. 17. Showers: rain. 18. Drizzle: clear. 19. Fine: clear: aurora. 20. Drizzle: damp. 21. Cloudy: damp. 22. Fine: clear. 23. Rain. 24. Fine: clear: aurora. 25. Fine: frost: clear. 26. Rain. 27. Clear. 28. Clear: frost: cloudy. 29. Bright: showers. 30. Fine.

Meteorological Observations made by Mr. Thompson at the Garden of the Horticultural Society at CHISWICK, near London; by Mr. Veall, at BOSTON; by the Rev. W. Dunbar, at Applegarth Manse, DUMFRIES-SHIRE; and by the Rev. C. Clouston, at Sandwick Manse, ORKNEY.

Days of Month.			Barometer.				Thermometer.				Wind.		Rain.						
1849. Nov.			Chiswick.		Dumfries-shire.	Orkney, Sandwick.		Chiswick.		Dumfries-shire.		Orkney, Sandwick.	Chiswick.	Dumfries-shire.	Boston.	Orkney, Sandwick.			
			Max.	Min.		9 a.m.	2 p.m.	8 a.m.	8 p.m.	Max.	Min.						9 a.m.	8 p.m.	
1.	29.605	29.439	29.13	29.37	29.51	29.64	29.67	57	35	47	51	42	46	42	se.	s.	enc.	calm	Orkney, Sandwick.
2.	29.607	29.578	29.29	29.50	29.49	29.53	29.45	58	37	47	50	36	44½	45	e.	s.	sw.	sw.	Dumfries-shire.
3.	29.503	29.345	29.25	29.43	29.23	29.43	29.19	55	42	38	50	36	46	44	e.	w.	se.	s.	Orkney, Sandwick.
4.	29.224	29.055	28.86	29.05	28.70	28.96	28.67	54	36	45	50	41½	46½	42½	c.	sw.	s.	calm	Orkney, Sandwick.
5.	29.308	29.106	28.65	28.63	28.98	28.53	28.77	53	33	38.5	50½	30	42	35	sw.	sw.	sw.	wnw.	Orkney, Sandwick.
6.	29.851	29.518	29.16	29.26	29.50	29.18	29.47	50	31	36	48	29½	35	35	sw.	s.	sw.	sw.	Orkney, Sandwick.
7.	30.077	29.973	29.69	29.62	29.70	29.69	29.82	57	40	36	36½	32	36	34	sw.	s.	se.	s.	Orkney, Sandwick.
8.	30.313	30.254	29.80	29.87	29.90	29.90	29.67	59	52	53	54	35½	36½	51	sw.	sw.	s.	sw.	Orkney, Sandwick.
9.	30.330	30.253	29.86	29.96	29.94	29.82	29.90	60	44	53	54	51	47½	51	se.	sw.	s.	sw.	Orkney, Sandwick.
10.	30.246	30.201	29.80	29.96	29.88	29.91	29.78	59	32	48.5	54	50	47½	46	sw.	s.	sw.	sw.	Orkney, Sandwick.
11.	30.277	30.260	29.79	29.93	29.88	29.83	29.83	60	35	48	54	51	50	47	sw.	s.	sw.	sw.	Orkney, Sandwick.
12.	30.168	30.012	29.72	29.81	29.70	29.71	29.66	55	35	40.5	55	50	50	46	sw.	calm	sw.	sw.	Orkney, Sandwick.
13.	29.896	29.708	29.90	29.52	29.50	29.44	29.40	55	39	33	53	46	47	45	sw.	calm	sw.	calm	Orkney, Sandwick.
14.	29.682	29.576	29.79	29.32	29.35	29.36	29.36	55	36	40	46	39	41	47	sw.	calm	sw.	calm	Orkney, Sandwick.
15.	29.720	29.604	29.72	29.42	29.73	29.53	29.89	48	35	39	46	34½	41½	42	sw.	n.	n.	e.	Orkney, Sandwick.
16.	30.087	29.967	29.64	29.92	30.05	30.03	30.13	48	25	32	47	40	41½	38	nw.	n.	n.	e.	Orkney, Sandwick.
17.	30.241	30.209	29.88	30.02	30.00	30.03	29.77	46	25	32	47	40	41½	38	nw.	n.	n.	e.	Orkney, Sandwick.
18.	30.211	29.987	29.72	29.80	29.80	29.62	29.90	52	43	42	52½	43½	50½	45½	sw.	sw.	sw.	sw.	Orkney, Sandwick.
19.	30.068	29.970	29.64	29.90	29.94	29.99	30.05	52	31	42.5	50½	40	43½	42	ne.	nw.	w.	ese.	Orkney, Sandwick.
20.	30.109	30.100	29.75	29.92	29.93	30.04	30.00	49	41	43	50½	45½	45½	47½	e.	n.	sw.	sw.	Orkney, Sandwick.
21.	30.074	30.015	29.70	29.87	29.81	29.93	29.90	48	34	44	49	44½	48	47½	e.	s.	ese.	se.	Orkney, Sandwick.
22.	29.896	29.749	29.55	29.69	29.53	29.72	29.50	45	32	38	47	43	45½	47	se.	s.	e.	se.	Orkney, Sandwick.
23.	29.677	29.326	29.30	29.29	29.18	29.34	29.27	52	37	39	47	33½	45½	42	s.	s.	se-sw.	ne.	Orkney, Sandwick.
24.	29.361	29.303	29.04	29.20	29.18	29.30	29.26	41	28	33	45	29	40	36½	se.	w.	se.	calm	Orkney, Sandwick.
25.	29.552	29.356	29.12	29.46	29.58	29.35	29.59	42	27	32	40	30½	44½	38	nw.	w.	se.	se.	Orkney, Sandwick.
26.	30.065	29.732	29.54	29.73	29.95	29.88	30.07	38	18	35	39	28	40½	39½	ne.	ese.	se.	se.	Orkney, Sandwick.
27.	30.138	30.136	29.87	30.04	30.03	30.12	30.12	36	21	30	36	28½	38½	38½	nw.	wnw.	e.	se.	Orkney, Sandwick.
28.	30.051	29.940	29.74	29.90	29.72	29.97	29.84	33	21	29	33	21	37	37	w.	nw.	se.	se.	Orkney, Sandwick.
29.	29.973	29.932	29.65	29.60	29.42	29.65	29.37	45	31	32	41	24½	36	41	s.	s.	s.	s.	Orkney, Sandwick.
30.	29.894	29.786	29.50	29.57	29.69	29.52	29.67	48	28	38	44½	39½	41	41½	sw.	s.	e-sw.	s.	Orkney, Sandwick.
Mean.	29.940	29.779	29.53	29.618	29.627	29.631	29.632	50.33	33.60	39.7	47.3	37.9	43.23	42.82					Orkney, Sandwick.
																			Orkney, Sandwick.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 26. FEBRUARY 1850.

IX.—*On the British species of Chara.* By CHARLES C. BABINGTON, M.A., F.L.S. &c.*

SINCE the genus *Chara* ceased to be considered as Phanerogamic and was placed as a Natural Order of Cryptogamic plants, its species have been excluded from our popular floras, and consequently suffered undeserved neglect from British botanists. The kindness of my friend Professor Henslow having recently placed in my hands a set of foreign specimens of *Chara*, which had been sent to him by Professor Alex. Braun of Freiburg in Breisgau, together with that botanist's notes upon some English *Charæ* submitted to his inspection, I have been induced to attempt the arrangement of our native species in a more complete manner than has as yet been done.

Since the time of Smith, who described all the British species known to him in his 'English Flora' (i. 6) which was published in 1824, only one complete account of our species has appeared, viz. that by Hooker (Eng. Fl. v. pt. 1. 242) in the year 1833, for Hassall's notice of them (Brit. Freshwater Alg. i. 94) cannot be considered as original. In that work Sir W. J. Hooker has characterized eight species, viz. 1. *translucens*; 2. *flexilis*; 3. *nidifica*; 4. *gracilis*; 5. *vulgaris*; 6. *Hedwigii*; 7. *aspera*; 8. *hispida*. More recently two have been added to this list, one by the Rev. M. J. Berkeley (Eng. Bot. Suppl. t. 2824) as the *C. pulchella* (Wallr.), which is considered in this paper as forming one species in combination with *C. Hedwigii* under the name of *C. fragilis*; and another by Mr. D. Moore (Lond. Journ. Bot. i. 43) as the *C. latifolia* (Willd.). The former botanist has also greatly elucidated the obscure subject of specific distinctions in this genus by his elaborate remarks in the same work under *C. Hedwigii* (Eng. Bot. Suppl. 2762). We have still to add an elegant little plant detected many years since in the fens of Cambridgeshire by Professor Henslow, and formerly supposed to be *C. gracilis*,

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but confidently referred by Professor Agardh, when in the year 1833 we had the pleasure and advantage of his company in an excursion into the fens, to his *C. hyalina*. Owing to the total absence until recently of nucules or globules from the specimens obtained, this plant has not, I believe, been published as a native species, although very many named samples of it have been distributed amongst botanists by Professor Henslow and myself. In this paper I have identified it with the *C. tenuissima* (Desv.), as is indeed done by Agardh, although he has preferred the name of *C. hyalina*; and have added to the list the *C. polysperma* (A. Braun), *C. syncarpa* (Thuil.), *C. mucronata* (A. Braun), *C. prolifera* (A. Braun), *C. Borreri* (Bab.), and *C. crinita* (Wallr.), thereby raising the number of our species to sixteen.

All these species, except two, are preserved in the herbaria of Prof. Henslow and myself, and as neither of us has paid any peculiar attention to this genus, but only collected such specimens as came accidentally under our notice, it is highly probable that several additions to the list will soon be made, and it is chiefly with the view of leading to such discoveries that it is now published.

In France, according to the list given by Lamotte (Cat. des Pl. Vasc. de l'Europe centrale) in 1847, nineteen species are found; in Germany we learn from the same book that there are eighteen species. Reichenbach (Fl. Germ. exc. 148 and 843) in 1833 described sixteen German species; and Fries (Summa Veg. Scand. 60) records fifteen species as natives of Scandinavia, but adds the remark, "spec. nondum pl. explor."

Since a considerable part of this paper was written, a valuable memoir by Prof. A. Braun has appeared in the 'Kew Miscellany' (i. 193), entitled "*Charæ australes et antarcticæ*," but including remarks upon the differences between the supposed genera *Chara* and *Nitella*, and pointing out new characters for their distinction. Notwithstanding the apparent value of these characters, I have thought it better to retain the name of *Chara* for the whole of the group until they have been carefully studied in the living plants, and their constancy and universality more fully proved. They are prefixed to the usual sectional characters in the ensuing arrangement of the species, in which I have followed that given by Prof. Braun in the above-mentioned memoir. I have also largely availed myself of the same distinguished botanist's valuable paper in the 'Flora, oder Botanische Zeitung' of Regensburg (xviii. 49), and his "Esquisse monographique du genus *Chara*" in the 'Annales des Sciences Naturelles' (ser. 2. i. 350), and have found the account of the species given by Mutel in his 'Flore Française' (iv. 159), and the plates in the 'Atlas de la Flore de Paris' by Cosson and Germain, very useful.

Nat. Order. CHARACEÆ, Rich.

Genus CHARA, Linn.

Section I. *Nitella*. Crown of the nucule of "ten cells, forming two circles one lying upon the other, never spreading, generally falling off before the maturation of the seeds" (A. Braun). Stems more or less pellucid, composed of a single tube.

A. *Nitellæ veræ*. Globules terminal at the furcation of the branchlets.

a. *Furcata*. Branchlets only once divided with one-jointed segments, 6-8 in a whorl, similar.

1. *C. flexilis* (Linn.); monœcious, stem slender equal flexible transparent, *branchlets pointed but not mucronate nearly equally forked* or trifid, nucules and globules together in the forks of the branchlets without bracts.

C. flexilis, Linn. *Sp. Pl.* 1624 (in part); *Eng. Bot.* t. 1070; *A. Braun in Flora*, xviii. 50; *Ann. Sc. Nat.* ser. 2. i. 351.

C. Brongniartiana, Wedd. in *Cat. Fl. Paris*. 152.

Nitella Brongniartiana, Coss. et Germ. *Fl. Paris*. 682; *Atl.* t. 40 C.

Rather slender, green, pellucid. Primary branchlets seldom more than once divided. Sometimes the axillary branchlets are much more divided and clustered, when it has passed for *C. nidifica* with collectors. Nucules with six striæ.

Henley near Ipswich, *Buddle*. Yarmouth, *Mr. D. Turner*. Berrington Pool, Salop, *Rev. E. Williams*. In the river at Bedford, *Dr. Abbot*; *Smith*. Richmond, Yorkshire, *Mr. J. Ward*. Stowting, Kent, *Rev. G. E. Smith*. Whitehorn, Wigtonshire; Clova, Forfarshire, *Prof. Balfour*. Reeche Lode, and Lord's Bridge near Barton, Cambridgeshire.

Annual. May. "April to August," *Sm*.

2. *C. syncarpa* (Thuil.); diœcious, stem slender equal flexible transparent, *branchlets bluntish apiculate nearly equally forked* or trifid, nucules or globules at the forks of the branchlets without bracts.

C. syncarpa, "*Thuil. Fl. Par.* 473;" *A. Braun in Flora*, xviii. 51; *Ann. Sc. Nat.* ser. 2. i. 352; *Mutel Fl. Franc.* iv. 160.

Nitella syncarpa, Coss. et Germ. *Fl. Par.* 682; *Atl.* t. 39 (not good).

A slender diaphanous plant closely resembling *C. flexilis*, but diœcious. Nucules with five striæ and scarcely any crown. It is the supposed *C. gracilis* of Mr. W. Wilson in *Hook. Bot. Misc.* i. 336. No. 2.

Woodmancote, Sussex, *Mr. Borrer*. Cwm Idwel, Caernarvonshire. Ma'am, Galway.

Annual. May.

b. *Mucronatae*. Branchlets usually repeatedly divided, terminal segments of two joints, last joint usually resembling a mucro. Branchlets 6-8 in a whorl, similar.

3. *C. translucens* (Pers.); monœcious, stem thick equal flexible transparent, *sterile branchlets simple* not jointed, *upper ones ending in two or three short points*, fertile whorls of small trifurcate branchlets very small and closely placed, nucules small oblong usually in threes just below the three bracts surrounding the terminal globule.

C. translucens, Pers. *Syn. Pl.* ii. 531; *Eng. Bot.* t. 1855; *A. Braun in Flora*, xviii. 51; *Ann. Sc. Nat.* ser. 2. i. 352; *Hook. Eng. Fl.* v. pt. 1. 245; *Mutel Fl. Franc.* iv. 160.

Nitella translucens, Coss. et Germ. *Fl. Par.* 682; *Atl.* t. 40 B.

A strong plant. Fertile whorls so disposed amongst the branchlets as to appear to be capitate. Globules solitary. Nucules with seven striæ. The fruit appears to be wrongly drawn in 'Eng. Bot.'

Deep stagnant pools. "Near Shrewsbury, Rev. E. Williams; Browston and Belton, Suffolk, Sir W. J. Hooker; Scotland;" Sir J. E. Smith. Bagnley Moor, Cheshire, Mr. W. Wilson. Totteredge, Middlesex, Mr. E. Forster. Loch Lubnaig, Perthshire; Lochnaw, Wigtonshire; near Liverpool; Prof. Balfour. Near the Fairlop Oak in Hainault Forest, Essex.

Annual. July.

4. *C. mucronata* (A. Br.); monœcious, stem slender equal flexible transparent, *branchlets strongly mucronate* nearly equally forked or trifid, *nucules and globules* together at the forks of the branchlets without bracts.

C. mucronata, A. Braun in *Flora*, xviii.; *Ann. Sc. Nat.* ser. 2. i. 351; *Mutel Fl. Franc.* iv. 161.

Nitella mucronata, Coss. et Germ. *Fl. Par.* 683; *Atl.* t. 40 D.

Rather thick for its length. Secondary branchlets once or twice forked or trifid, the terminal subdivisions rather shorter than the others. "Nucules with four or five striæ."

Marsh ditch at East Grinstead, Sussex, Mr. Borrer.

Annual. July.

5. *C. gracilis* (Sm. !); monœcious, stem slender equal flexible transparent, *branchlets in lax whorls* repeatedly divided into three or four segments, terminal segments mucronate shorter than the others, globules and nucules each solitary but together at the subdivisions of the branchlets without bracts.

C. gracilis, Sm. ! *Eng. Bot.* t. 2140; *Reich. ! Iconog.* t. 793; *A. Braun ! in Flora*, xviii. 53; *Ann. Sc. Nat.* ser. 2. i. 351; *Mutel Fl. Franc.* iv. 160; *Hook. Eng. Fl.* v. pt. 1. 245 (in part).

Nitella gracilis, *Agardh Syst. Alg.* 125 ; *Coss. et Germ. Fl. Par.* 683 ; *Atl.* t. 41 E.

A very small and slender plant, its branchlets spreading in a lax open manner, and much longer than those of *C. tenuissima*. Nucules subglobose, with four or five striæ, large in proportion to the plant.

My judgement of this species is formed from the plate in 'Eng. Bot.' and a small but good specimen of the original plant, for which I am indebted to Mr. Borrer.

Mr. Wilson's *C. gracilis* from Cwm Idwel is *C. syncarpa*.

St. Leonard's Forest, Sussex, Mr. Borrer.

Annual. September?

6. *C. tenuissima* (Desv.) ; monœcious, stem slender equal flexible transparent, *branchlets short in dense compact subglobose whorls* repeatedly divided into 3-7 segments, terminal segments mucronate longer than the others, globules and nucules each solitary but together at the subdivisions of the branchlets without bracts.

C. tenuissima, Desv. " *Journ. Bot.* ii. 313 ;" Reich. ! *Iconog.* t. 792 ; *A. Braun!* in *Flora*, xviii. 53 ; *Mutel Fl. Franc.* iv. 159.

C. glomerata, *A. Braun!* in *Ann. Sc. Nat.* ser. 2. i. 351, not *N. glomerata*, *Coss. et Germ.*

C. batrachosperma, Reich. *Iconog.* t. 794.

Nitella tenuissima, *Coss. et Germ. Fl. Par.* 681 ; *Atl.* t. 41 F.

N. hyalina, *Agardh!* *Syst. Alg.* 126, not *DeCand.*

A very small slender plant, its short much-divided branchlets forming little globular compact masses which are often much incrustated. Nucules subglobose, with 6-8 striæ, three times the diameter of the branchlets and placed outside of them. Globules much larger than the nucules.

I have recently (Aug. 6, 1849) found a profusion of ripe nucules and a few globules upon this plant in Bottisham Fen, and with the assistance of Messrs. J. D. C. Sowerby and J. W. Salter have succeeded in satisfactorily ascertaining their positions to be in accordance with the section in which the plant is here placed.

In peaty ditches and pits in the fens of Cambridgeshire.

Annual. July, August.

B. *Tolypella* (A. Braun). Globules placed laterally on the nodes of the chief ray of the branchlets between the lateral rays (bracts) which are always shorter than the chief ray.—Rays of many gradually decreasing joints.

Note.—This little group of singular plants presents more difficulty than either of the other sections, and I am very far from being convinced that a correct view of it is taken below. My

original idea was that the plants only formed one species, but further study has convinced me that they are far too different to allow of their being lumped to that extent, and I am reduced to the necessity of considering them all as distinct. They appear to be very short-lived, and in all probability will be found to produce two crops in the year, one in the spring and the other autumnal.

7. *C. Smithii*; diœcious, stem slender equal flexible transparent, *branchlets blunt those forming the primary whorls simple sterile long jointed (?)*, the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first node, *globules stalked subtended by the three shorter bracts*, nucules unknown.

C. nidifica, Sm. *Eng. Bot.* 1703 (principal figure).

A small plant remarkable, like the following species, for its bird's-nest-like masses of branchlets which spring from the axils of the simple branchlets forming the primary whorls. It is only known to me from the figure in 'Eng. Bot.' and from some remarks for which I am indebted to Mr. Borrer, and upon which the above specific character is founded.

As the *C. nidifica* (Müll.) is stated by Professor A. Braun (Hook. Kew. Misc. i. 200) to be "peculiar to the north of Europe, and particularly to the Baltic," and can therefore scarcely be the same as this plant, which was found "in a ditch which I believe the tide never reaches" (Borrer in Eng. Bot. Suppl. fol. 2762, note); and as the plate in 'Fl. Danica' is far too imperfect to allow of its identification with either of our *Tolypellæ*; I have thought it better, with the concurrence of Mr. Borrer, to confer a new name upon this plant, which was unfortunately made the representative of his *C. nidifica* by Smith by placing a figure of it in the principal place on the plate in 'English Botany.' I have the authority of the same botanist for saying that the following species was the plant really intended to bear that name. The confusion has originated from the idea prevalent at the time when the figure was published, that the diœcious plant from Lancing was a form of the monœcious one found at Cley. Unfortunately these plants are so evanescent that it is only by chance that they are again found in their original localities, where their seeds probably remain dormant until favourable circumstances cause them to germinate.

Lancing, Sussex (1804-5), in a ditch which the tide probably never reaches; not in Shoreham Harbour, as erroneously stated in 'English Botany.' Mr. Borrer.

Annual. Autumnal.

8. *C. prolifera* (A. Braun) ; monœcious, stem slender equal flexible transparent, *branchlets blunt those forming the primary whorls simple sterile long usually of three or four joints, the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first node, globules sessile (?) in company with one or more nucules and "subtended by the three shorter bracts."*

C. prolifera, *A. Braun in Flora*, xviii. 56 ; *Ann. Sc. Nat.* ser. 2. i. 352.

C. glomerata, *Mutel Fl. Franc.* iv. 161, not *A. Braun* nor *N. glomerata*, *Coss. et Germ.*

A small plant easily confounded on a superficial view with the preceding, from which it is distinguished by being monœcious. Nucules small with faintly marked striæ. Granules apparently sessile. The presence of decided bracts distinguishes this plant and the preceding and following from *C. polysperma* and *C. flexilis*, the species with which they are in the most danger of being confounded. There can be no doubt that the three smaller appendages are really bracts, although, in all probability, the longer (fourth) one is a subdivision of the branchlet.

In brackish (?) ditches. Cley, Norfolk, *Mr. D. Turner*. Copford, Essex.

Annual. April. "August to October," *Sm.*

9. *C. Borreri* ; monœcious, stem slender equal flexible transparent, *branchlets strongly mucronate those of the primary whorls simple sterile long jointed, the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first and also sometimes second node, globules stalked or sessile in company with several nucules and subtended by the three shorter bracts.*

C. nidifica, *Borr. ! in Eng. Bot. Suppl.* fol. 2762, note.

Closely resembling *C. prolifera* and *C. nidifica*, but considerably larger ; agreeing with them in most respects, but essentially different in its branchlets being "suddenly contracted below the acute apiculus." It also differs by sometimes producing a second cluster of bracts and fructification on its branchlets, and also occasionally having one on the larger "bract," which is thus shown to be more correctly a subdivision of the branchlet than a bract. The three true bracts are placed on the under side of the branchlet and at right angles with it, the fourth supposed "bract" is lateral and usually points upwards ; and their arrangement is believed to be exactly like that in *C. prolifera* and *C. Smithii*. This plant is chiefly known to me from the description in 'English Botany,' and from some manuscript notes, for

which I am indebted to Mr. Borrer; and as it does not seem to have been noticed elsewhere, I have ventured to record it as a new species, and honour it with the name of my valued friend.

In a marsh ditch at Henfield, Sussex, Mr. Borrer.

Annual. July.

10. *C. polysperma* (A. Br. !); monœcious, stem slender equal flexible transparent, *branchlets finely pointed those of the primary whorls sterile once or twice unequally branched*: middle subdivision longest, the other branchlets on axillary branches numerous densely crowded much subdivided with short internodes, nucules and globules placed at the nodes of the branchlets "between the lateral rays" (or bracts?).

C. polysperma, A. Braun "*Fl. Bad. Crypt.*;" *Flora*, xviii. 56; *Ann. Sc. Nat.* ser. 2. i. 352; *Mutel Fl. Franc.* iv. 162.

C. fasciculata, "*Amici*," A. Braun.

A small plant resembling the preceding species, and having like them bird's-nest-like masses of branchlets. My specimens are slightly incrusted, as is stated to be the case in those found in France. Nucules small with faintly marked striæ. Granules small.

I gathered this species in the year 1833 near Haslingfield in Cambridgeshire, but have not been able to find it there again. As numerous specimens were obtained by a party at that time, it is probably preserved in many collections under the name of *C. nidifica*, with which denomination it was sent to Prof. Braun and named by him as above. Mr. Borrer possesses specimens found at Livermere near Bury St. Edmunds by the Rev. G. R. Leathes. Annual. April.

Section II. *Chara*. Crown of the nucule of "five cells forming a simple circle and sometimes spreading, persistent" (A. Braun). Stems usually coated with smaller tubes.

Chara veræ. Granule taking the place of one of the bracts.—*Diplostephanae* (A. Br.). A double row of spines (stipules) at the base of each whorl.

- a. Stem coated with as many tubes as there are branchlets in each whorl.—Branchlets coated.

11. *C. crinita* (Wallr.); diœcious, stem slender *coarsely striated thickly beset with setaceous patent clustered spines*, branchlets abbreviated, bracts whorled slender equal, *nucules narrowly oblong* shorter than the bracts.

C. crinita, Wallr. *Ann. Bot.* 190. t. 3; A. Braun in *Flora*, xviii. 70; *Ann. Sc. Nat.* ser. 2. i. 355; *Mutel Fl. Franc.* iv. 165.

C. canescens, Reich. *Fl. exc.* 150.

Hippuris, &c., Plukn. *Phytog.* t. 193. f. 6. Wallr.

Stems slender, erect, flexible even when dry, smooth, not opaque, densely crowded, slightly branched, pale green. Lower whorls rather distant, upper ones gradually closer, of 8–10 short branchlets each with six nodes and a whorl of five bracts at each node. Bracts usually as long as the internode. Nucules solitary with thirteen striæ and a prominent crown. My British specimens are of the male plant only.

Wallroth refers Pluknet's Irish plant to this with certainty; I have doubts.

In stagnant ponds. Burdock Pool, Falmouth, Cornwall, *Rev. W. L. P. Garnons*.

b. Stem coated with twice as many tubes as there are branchlets in each whorl. Branchlets coated, uppermost joints sometimes naked.

12. *C. vulgaris* (Linn. ?); monœcious, *stems scabrous finely striated* brittle, upper part of the branchlets without external tubes, bracts only on the inner side of the branchlets long: two 2–4 times as long as the nucules, and two equaling them.

C. vulgaris, *Linn. Sp. Pl.* 1624 (in part); *Eng. Bot.* t. 336; *Ag. Syst. Alg.* 128; *Hook. Eng. Fl.* v. pt. 1. 246.

C. foetida, *A. Braun "Fl. Bad. Crypt.;" Flora*, xviii. 63; *Ann. Sc. Nat.* ser. 2. i. 354; *Mutel Fl. Franc.* iv. 162; *Coss. et Germ. Fl. Par.* 679; *Atl.* t. 37.

Plant diffuse, almost always incrustated. Branchlets appearing, at the first view, jointless, minutely pointed. Nucules with thirteen striæ and a short crown, accompanied by the globule. Bracts thick.

Varying greatly in appearance, size and roughness, sometimes hispid, sometimes much denuded of the outer tubes in the upper part. A very much condensed form is the *C. montana* (Schultz), *Reich. Fl. exsic.* 2143. The Linnæan *C. vulgaris* appears to include this and several other species.

Ditches and streams: common. *C. montana*, Gilsland, Cumberland, *Mr. W. Christy*.

Annual. June to August.

13. *C. hispida* (Linn.); monœcious, *stem thickened upwards spirally sulcate rough brittle* beset with setaceous spines, branchlets elongated, bracts whorled (inner ones much longer), *nucules ovate* shorter than the bracts solitary, accompanied by a globule.

C. hispida, *Linn. Sp. Pl.* 1624; *Eng. Bot.* t. 436; *Wallr. Ann. Bot.* 187. t. 4; *Hook. Eng. Fl.* v. pt. 1. 246; *A. Braun in Flora*, xviii. 66; *Ann. Sc. Nat.* ser. 2. i. 355; *Mutel Fl. Franc.* iv. 163; *Coss. et Germ. Fl. Paris.* 679; *Atl.* t. 38 B.

Stems opaque, greenish white, usually incrustated, covered with

minute tubercles; spines generally very numerous, sometimes almost wanting; whorls of elongate, acuminate (by having the terminal segment denuded of outer tubes) branches, each of which has about six nodes and a whorl of 4-5 short bracts at each node.

Pits and deep ditches, especially on a peaty soil.

Annual. May to August.

14. *C. tomentosa* (Linn.) ; diœcious (?), stem thickened upwards spirally sulcate rough brittle armed with *scattered obtuse papillæ*, branchlets incurved, bracts unilateral ovate-oblong mucronate-acute, nucule shorter than the bract on each side of it longer than the three in front.

C. tomentosa, Linn. *Sp. Pl.* 1624 ; Fries! *Herb. Norm.* v. 100 ; *Mutet Fl. Franc.* iv. 163 ; Reich.! *Fl. exc.* 150.

C. latifolia, Willd.! " *Berol. Schr.* iii. 129 ; " *Hook. Icon.* t. 532.

C. ceratophylla β . *macroptila*, A. Braun in *Flora*, xviii. 65 ; *Ann. Sc. Nat.* ser. 2. i. 355.

The granules and nucules are probably upon different plants. Stem opaque, whitish green, covered with very minute tubercles, and bearing distant somewhat whorled short obtuse papillæ. Branchlets like the stem; their terminal division thicker, inflated, of one pellucid tube. Bracts pellucid, barren ones unilateral (?). "Nucule with a large ovate bract on each side, and three small linear-oblong ones in front, also having three minute acute tubercles on the opposite side of the stem. Globule from a whorl of two or three large bracts not having smaller ones in front, but with two or three tubercles on the opposite side of the stem." *Hooker*.

In the foreign plant (Reich. *Fl. exsic.* 92, which is the authentic *C. latifolia*, Willd.), the bracts are apparently whorled. Fries's specimen (*Herb. Norm.* v. 100) is without any incrustation, smooth and scarcely twisted. Our plant is certainly the *C. tomentosa* (Linn.), *C. latifolia* (Willd.), and the *C. ceratophylla* (Wallr.) is a variety of it.

Belvidere Lake, Westmeath, Ireland, Mr. D. Moore.

- c. Stem coated with three times as many tubes as there are branchlets in each whorl.

15. *C. aspera* (Willd.) ; diœcious, stem finely striate smooth flexible beset with setaceous patent spines, branchlets abbreviated, bracts whorled slender (two inner ones longer), nucules narrowly oblong shorter than the bracts.

C. aspera, " *Willd. in Berol. Mag. d. N.* iii. 298 ; " *Wallr. Ann. Bot.* 185. t. 6. f. 3 ; A. Braun! in *Flora*, xviii. 71 ; *Ann. Sc. Nat.* ser. 2. i. 356 ; *Mutet Fl. Franc.* iv. 164 ; *Coss. et Germ. Fl. Paris.* 680 ; *Atl.* t. 38 D ; *Eng. Bot. Suppl.* t. 2738 ; Fries! *Herb. Norm.* iii. 100.

Stems erect, not opaque, pale green, densely crowded; spines usually scattered, often very short, or irregularly collected in whorls (when it much resembles *C. crinita*, Wallr.); whorls of 6–9 branchlets of six nodes and a whorl of 4–5 bracts at each node; bracts as long as the internode or shorter than it. Nucules solitary, with twelve or thirteen striæ and a prominent crown.

Distinguished from *C. crinita*, as is well remarked by Prof. A. Braun in his letter to Prof. Henslow, “by the more slender outer tubes of the stems.” I am doubtful concerning the plant figured by Greville (Scott. Crypt. Fl. t. 339), for he places nucules and granules upon the same plant.

In stagnant water. Orkney, *Mr. Clauston*. Prestwich Car, Northumberland, *Mr. Robertson*; Greville. Irthing, Durham, *Mr. Bowman*; Hooker. Cleifog Farm, four miles from Holyhead, Anglesea, *Mr. Wilson*. Carlton, Notts, *Mr. Borrer*. Burdock Pool near Falmouth, Cornwall, in company with *C. crinita*, *Rev. W. L. P. Garnons*. Loch of Skail, Orkney, *Miss Watt*. In the river Shannon near Portumna, Galway, *Mr. D. Moore*; *Prof. Balfour*.

16. *C. fragilis* (Desv.); monœcious, stems slender finely striated smooth not spinous, last 1–3 joints of the branchlets without external tubes, bracts on the inner side of the branchlets about as long or longer than the oblong nucules.

C. fragilis, “*Desv. ap. Lois. Not. Fl. Franc.* 137;” *A. Braun in Flora*, xviii. 68; *Ann. Sc. Nat.* ser. 2. i. 356; *Reich. Fl. exsic.* 94; *Mutet Fl. Franc.* iv. 164; *Coss. et Germ. Fl. Paris.* 680; *Atl.* t. 38 C. *C. pulchella*, *Wallr. Ann. Bot.* 184. t. 2; *Eng. Bot. Suppl.* t. 2824; *Ag. Syst. Alg.* 129.

C. Hedwigii, *Ag. Syst. Alg.* 129; *Eng. Bot. Suppl.* t. 2762.

Slender, green, not incrusted. Main stem and branches usually with equally long branchlets. Nucule with thirteen or fourteen striæ and a long crown, accompanied by the globule. Bracts usually shorter than the nucules, but one equaling them in length; sometimes (*C. fragilis longibracteata*, A. Braun!, *C. delicatula*, Ag.?) longer than them.

The *C. Hedwigii* scarcely differs except in being very brittle when dry, the bracts shorter, and the branchlets of the main stem usually much longer than those of the branches.

Ponds. Sussex, *Rev. M. J. Berkeley*. Derwentwater, *Rev. E. A. Holmes*. Serk, *Rev. T. Salwey*. Paradi, Guernsey.—Var. *longibracteata*; West Chilton Common, Sussex; Berrington Pool, Shropshire.—*C. Hedwigii*; East Grinstead, Sussex; Sandwich, Kent, *Rev. M. J. Berkeley*.

Annual. June to August.

X.—*Observations on the species of Termitidæ of West Africa, described by Smeathman as Termes bellicosus, and by Linnæus as T. fatalis.* By T. S. SAVAGE*.

HAVING read a condensed account and many extracts from the communication of Dr. Smeathman to the Royal Society of London on the insect in question, it seemed to me that no room was left for the discovery of additional facts. But, residing in the locality of the Termes, I felt a desire to know personally their œconomy; first, from motives of interest in the general subject of natural history; and secondly, in order to discover some way of preventing their supposed attacks on our buildings.

As I proceeded, I noticed some mistakes made by Dr. Smeathman or his many copiers, which induced me to record my own observations. Of these the following is a summary.

I would here remark, that I have never seen the original nor entire publication of Dr. Smeathman's paper; but what I have seen, is sufficient to show that he was an acute observer, a man of indomitable perseverance and accurate to a remarkable degree. The best account that I have read of his paper is that of Edward Newman, Esq., F.R.S., in his 'Familiar Introduction to the History of Insects.' It is free from the marks of a prurient imagination, and indicates more of a desire to relate the simple truth in the history of the insect than any that I have seen. The figures, however, which stand at the head of his account are decidedly bad.

The first thing that strikes a visitor who is familiar with Adamson's and Smeathman's observations, when he arrives on the coast of Africa, is the great sparseness of the Termites' hills. Instead of "acres so thickly covered as to appear like the huts of native settlements," his eye may wander over acres *without seeing one*; one cause of this sparseness may have arisen to some extent from the introduction of civilization. The visitor usually lands first at the European or American settlements, where the hills in their immediate vicinity are mostly destroyed. This has been done, first, from the notion that the insect "ate down their dwellings;" and, secondly, from the superiority of the clay of which they are constructed, which is used for building purposes. At no point, however, between Cape Verd and the Gaboon river, will the stranger remark them for their numbers.

They more frequently occur on plane and flat lands; making their appearance especially soon after the lands have been cleared for planting, at which time trees are left girdled and prostrate to decay.

* From the Proceed. Acad. Nat. Sci. of Philadelphia, vol. iv. No. 11.

The features which first strike the beholder are their great size and form. These have been well represented by Smeathman, though two hills cannot be found exactly like. Their contour is generally that of a hay-stack—the surface never regular, always marked with protuberances and upward projections, often not unlike “turrets,” as termed by Smeathman.

Sometimes the hill presents the aspect of a mound having been worn down by the heavy rains, or, if in the vicinity of a village, by children playing upon it. In such cases they may be forsaken.

When they present distinct upward projections or turrets, they are known to be in the process of enlargement. This is always the mode in which these insects increase their domiciles. Turrets are projected one after another, and the intervening spaces filled out, so as to make a continuous surface. Within each of these turrets is a cavity which leads down as a passage into the interior of the hill, or terminates in some other passage, keeping up a free communication throughout the structure. When hills present in their general outline the form of a hay-stack, they have arrived at their maximum size. Their height in such cases is from 12 to 15 feet perpendicular measurement, the circumference at base from 50 to 60 feet; at two-thirds the height, or around the base of the “dome,” from 30 to 40 feet.

The materials have for their base clay, generally strongly tinged with oxide of iron in the recent state; after exposure to the sun and atmosphere it takes on a light colour, approaching a dull yellow, in some cases white. There is an admixture, more or less, of other substances incidentally occurring, as gravel, leaves, straw, &c.

Sometimes the clay presents a dark, slaty aspect, which is incorrectly stated in books to be an indication of a different species of insect. This fact is owing to different-coloured clays existing in different localities.

The strength of these structures is incalculably great; as an evidence of this, Smeathman states that they are often mounted by wild bulls, and four men were known to stand on one to spy a vessel at sea. But more than this, *they would sustain more wild bulls and men than could possibly mount them.* The particles of clay are cemented together by a fluid excreted from the mouth of the insect (not as Smeathman says, by gums elaborated from the different kinds of wood on which they feed). This, by exposure to the sun and atmosphere, becomes exceedingly hard and tenacious on the surface, added to which, the action of the well-known principle in mechanical philosophy involved in the arched form of the structure gives to it a vast degree of strength. This feature in the œconomy of the *Termes fatalis*—the strength of

the domiciles—is a wise provision in nature. It guards the hills against the heavy wasting rains of the country, and enables them to resist the shock of decayed falling trees, which so often occur on recently cleared grounds. When it is known that it is the practice of the natives of Africa not to plant the same piece of ground two years in succession, but let it lie fallow four or five years, and clear up a new spot every year, and as many trees are girdled and left to decay and fall, the wisdom of this feature will be understood.

On clearing away the shrubbery and grass around the base of a hill, several covered ways or clay tubes will be seen leading to neighbouring stumps and decayed logs. These tubes, sometimes 12 inches in diameter at base, gradually diminish, ramifying as they proceed outward. If their connection with the hill be broken, as many holes will be seen, constituting mouths of passages, which run in a sloping direction to a depth of 12 or 18 inches under the domicile. These passages expand into basement rooms, bounded by clay pillars, supporting a series of archwork on which rest the “cellular work,” “royal apartments,” and superincumbent interior portions of the structure.

The exterior of the hill consists of a clay wall varying in thickness on the different sides from 6 inches to $1\frac{1}{2}$ foot. Throughout this wall there are cavities, cells and passages, anastomosing and running from the base to the apex, forming a communication with the “dome.” Within, at the base, elevated to a height of *one to two feet above the surface of the ground*, and central in respect to the circumference of the hill, is the apartment of the king and queen, styled by Smeathman “the royal chamber,” surrounded by many other apartments or chambers, containing eggs and young of various sizes and stages of growth, all supported by the archwork mentioned.

It will be observed, that Mr. Smeathman states that the “royal apartments” are on a level with the surface of the ground; but, *in every case*, I have found them elevated from 1 to 2 feet, depending on the height of the structure. Indeed, at certain seasons, this elevation becomes a matter of necessity in many localities. Were it otherwise, the royal pair would be in danger of inundation during the long and violent rains of that country.

Immediately above the royal apartments, extending across and up the sides of the hill to about two-thirds their height, are the “nurseries” of Smeathman, a yellow, dry, comb-like granulated substance, inclosed in moist red clay, so moist that it can be made by the hands into balls. In this substance are numerous narrow serpentine cavities or cells, containing eggs and young in different stages. Scattered on the surface are perceived, in a recent state, many minute white globular fungi. Imme-

diately above, and interior to the nurseries, lie the "magazines" of Smeathman, rising to the height of about a foot. These are a cellular arrangement of soft clay, filled with a dark brown granulated substance, supposed by Mr. Smeathman to be the "food." It is very moist, and appears to be vegetable substance, committed and reduced to this state by the insect.

Between the royal apartments and nurseries is the first-floor of Smeathman; immediately above the magazines is the *second*; then comes the "dome," a large cavity in the upper part of the structure. With the dome there is a communication by numerous passages with the different parts of the hill, and thus a free circulation of warm air kept up, giving a uniform temperature to the domicile. The principles of philosophy known in the tendency of air to an equilibrium, its ascent when rarefied, condensation and descent in coming in contact with a colder medium, thus securing a uniformity of temperature, are all involved in this peculiarity of structure.

The statement of Dr. Smeathman respecting the primary size and subsequent mode of increase of the royal apartments is a matter of deduction, though undoubtedly correct. In small hills the queen is found of corresponding size. As the hills increase, the size of the queen and her apartments are known to increase. The adjacent portions must be taken down to meet this enlargement. This is true also of other portions of the structure. As the outer projections, or turrets, are sent up from within, and the intervening spaces filled out, a portion of what was previously the exterior must be removed, to admit of the expansion of the interior arrangements, the nurseries, magazines, &c. This change and removal must be more or less true, also, of almost all parts of the domicile.

The community was divided by Smeathman into three orders: 1st, the workers; 2nd, soldiers; 3rd, the perfect insects, male and female, or king and queen; a fourth order or state was subsequently noticed by Latreille among another species in the south of France, at Bordeaux (*Termes lucifugus*). It was afterwards observed in the East Indies, and incidentally noticed by an anonymous writer in manuscript on a Ceylonese species (Kirby and Spence's *Introduct.* vol. ii. p. 33). This was the nymph or pupa state of the *workers*, in which rudimental wings were observed. The same state was inferred and averred of *T. fatalis*, by Messrs. Kirby and Spence, and adopted by compilers. I have never known this inference to be confirmed by any observer writing on the African species; but I am happy in being able to assert the fact from personal observation, and, furthermore, to declare the *same of the soldiers*. I have seen both with rudimental wings distinct. Messrs. Kirby and Spence suppose the

pupæ to be equally active with their respective larvæ, which is not the case; they are exceedingly delicate and sluggish.

Of these several orders, the labourers are by far the most numerous. They seem to be susceptible of two divisions—*larger and smaller labourers*. The latter exceed the former in numbers, and are found chiefly in the domicile. The work about the hill, such as constructing, repairing, bearing away the eggs from the maternal department, &c., seems to be done by them. Of the larger size, some few are found in the hill, but they exist in greater numbers in the covered ways, about and in the objects of plunder. The mandibles of this division are very hard and strong, and admirably adapted to the performance of what I suppose to be their part in the community, which is the comminuting of the different kinds of wood on which they prey, and the reducing of the clay from which their hills are made to a portable condition. A like division of labour I have noticed among the Driver Ants of Africa (*Anomma arcens* and *A. rubella*). Messrs. Kirby and Spence are incorrect when they say (Introduction. vol. ii. pp. 40, 41) that “they carry in their mouths a mass of mortar half as big as their bodies, ready tempered, made of the finer parts of *gravel*, which, worked up to a proper consistence, hardens to a substance *resembling stone*, of which their nests are constructed.” The amount each insect carries at a time is so small as to be hardly perceptible to the naked eye. When the work is done it presents a minutely granulated appearance, like that of the “nurseries.” Nor is it already “tempered,” ready to be laid. The insect, when it arrives at the place of deposit, stops for an instant, and retaining its hold on the piece of clay, undergoes a slight tremulous movement, more perhaps like the spasmodic action of vomiting, when *a fluid being seen to be excreted from the mouth* over it, the clay is deposited. This corrects the supposition of Smeathman, that the cementing medium was gum obtained from the trees on which they preyed. The outer surface of the work when recent presents a red, moist, granulated appearance, but when acted on by the sun and atmosphere it approaches a dull white or yellow, and is highly indurated, more so than simple clay dried in the sun can be. It however falls far short of the hardness of stone; as the hill is penetrated, the clay becomes softer until the interior is found to be so plastic that it can be made into balls under the pressure of the hand. The young of this order are seen of all sizes; the *nymphæ* of Latreille differing from the others apparently in no respect but that of their rudimentary wings.

Soldiers.—Of this order there seems to be ground for two divisions also, *larger and smaller*.

When a breach is made in the hill, the smaller soldiers are

seen with the labourers in small numbers, and retreat with them to the interior. Then appear the larger soldiers, whose duty especially it is to defend the community. Their conduct, ferocious aspect, &c. have been well described by Smeathman, and need not be here repeated. It has been said, however, whether by Mr. Smeathman or not, I cannot state, that in the act of biting "they never quit their hold even though they are pulled limb from limb" (Kirby and Spence, *Introduct.* vol. ii. p. 40).

This assertion has been correctly made of the Driver Ants of Africa (*Anomma arcens* and *A. rubella*), but cannot be of the *Termes fatalis*. It is the habit of this insect to let go immediately after biting, and strike as fiercely at another place, doing this several times in quick succession. The manner in which its jaws operate will not admit of a continued hold. Like scissors (unlike the mandibles of the *Anomma*) they cross each other, separating the fibres by a clear cut through.

In about fifteen minutes after the attack of the enemy, the work of reparation begins by the labourers, who, accompanied by a few of the smaller soldiers, and occasionally a larger, appear in great numbers. In view of the duty performed by these two orders, it is a surprising fact that both males and females are without eyes.

These, at particular seasons, leave the hills in vast numbers. "The rains," as they are familiarly termed in Africa, begin in May, sooner or later, and continue with some intermissions until October. During the month of July, and sometimes extending into August, an intermission takes place under the name of "middle dries," dividing them into "early and latter rains." At the beginning of these seasons—"early and latter rains,"—the *Termes swarm* (if it may be so called) in incalculable numbers. At their exit so rapid is their ascent, that they present the appearance of smoke rising from all parts of the hill. The holes through which they escape are temporary, created for this purpose, and closed when the *swarming* ceases. During this process, the atmosphere for many rods distant seems to be filled with them. Birds are then seen whirling and darting through the air in quick pursuit—all orders of insect-eating animals are now on the alert. Barn-yard fowls are seen to jump up several feet from the ground to catch them as they descend. Indeed, men as well as brutes make them their prey. All tribes of Africans however do not eat them. The Grebos, who inhabit Cape Palmas, and among whom these observations were made, reject them as food. Why, it is difficult to tell, unless it be from the trouble attending their capture. It is not from any fastidiousness of taste, for they are known to eat snakes, toads, grubs, beetles, and even putrid meat, with zest. Tribes about fifty miles to the

windward of Cape Palmas use them as food. To catch them, bowls of water are set on the ground, into which they fall as their wings drop off. They are then roasted as shrimps, and the larger beetles (*Goliathi*) are said to be equally sweet.

The individuals of the two sexes appear to be about the same size when they issue from the hill, *not exceeding half an inch*. The largest queen I have ever seen at the head of a community measured $4\frac{3}{4}$ inches in length.

Messrs. Kirby and Spence state that the queen lives but two years, which is incorrect. I have observed the yearly increase of hills for *five years* or more, and, when dissected, they have yielded a queen of corresponding size. To say that a successor to the original one might have been elected would be gratuitous. Nothing is known of their habits to warrant such an assertion, while everything we do know goes to prove that they live for many years.

It is stated also, that but one queen is ever found in a hill. This, too, is incorrect. But one is generally found. I have known two to occur. They were contained in the same structure, called by Smeathman "the royal chamber," but separated by a septum of clay. The hill was of the usual size. It was "dug down" by a colonist at Cape Palmas, who, knowing that I was investigating the habits of the insect, kindly brought them to my residence. I regretted exceedingly my inability to decide the question which arose to my mind at first sight, "Is it a case of bigamy?" The person who discovered them took no notice, and was unable to say that he saw even one king. It occurred to me that it might be an anomaly. I therefore made inquiries at Montserrado and the different European settlements that I visited, and ascertained that the same thing had occurred at those points, though it was considered quite unusual.

I am able here to confirm the truth of Mr. Smeathman's statement, that the king and queen are permanently inclosed in their apartment, which has been doubted by the eminent writer of the article *Termitidæ*, in the 'British Cyclopædia of Natural History' (understood to be J. O. Westwood, Esq.).

The sentence in which the doubt occurs runs as follows:—"The young queen of the hive swarms is followed by a portion of the community; and the female after swarming, and the loss of her wings, is guarded by the worker ants; there is, therefore, so much analogy in these circumstances that we are almost tempted to consider that Smeathman must have erred in stating that the working Termites imprison both the king and queen Termites. That it should be necessary for the latter to be carefully guarded will be very evident; but why the king in his helpless and wingless state (for we consider that the loss of wings is

consequent upon and not precedent to pairing) should be shut up, seems questionable. We make these observations with hesitation, because Latreille, and Kirby and Spence seem to adopt, without hesitation, this statement of Smeathman."

I feel it my duty to notice particularly this doubt, coming as it does from a source of such high respectability as the present Corresponding Secretary of the London Ent. Soc., J. O. Westwood, Esq.

It should be remembered that in penning this doubt, Mr. Westwood was sitting within-doors at Hammersmith, England, many thousand miles distant from the scene of Mr. Smeathman's patient and prolonged observation. Mr. Smeathman states what he *knew to be a fact*, and respecting which I can see no way in which he could be mistaken. Mr. Westwood misapprehends a remark of Mr. Smeathman on their "swarming," if it can be so called. I do not understand Mr. Smeathman to state that the queen is accompanied by any other individuals than those of the two sexes—other perfect *males and females*. He says that as *workers* are always to be found on the *surface of the ground*, the king and queen are *captured by them*, and thus made to become the heads of new communities. On what foundation *this* statement rests I know not; but must confess that in this part of their œconomy I think there exists a lacuna yet to be filled. As to the statement, however, involving the perpetual imprisonment of the king and queen, I have no doubt. The facts respecting the structure of the "royal chamber" sufficiently prove it. Any one who has seen a fully-developed queen will say that she is incapable of progression, and the fact that no aperture has been discovered in the "chamber" among the many hills dissected at different seasons, sufficient to admit of the ingress and egress of the king, and hardly of the larger class of soldiers, must suffice.

It has been stated also by compilers of Smeathman, that the insect shrinks from light, which is a reason for their constructing covered ways. But if it be remembered that the two orders—soldiers and workers—are perfectly blind, the assertion must appear to be gratuitous. The true cause of their erection of covered ways would seem to lie in the fact that the insect is a prey to a vast number of other insects, reptiles, &c.

Smeathman and others state that *Termes bellicosus* is the insect which devours dwelling-houses, furniture, &c. This also I consider an error. I doubted its accuracy at the commencement of my observations, and made inquiries subsequently of intelligent observers at Sierra Leone and Montserrado, all of whom confirmed me in my doubts. The white ants found in our houses preying on our furniture, books, &c. are *smaller*, and larger in proportion to their breadth, than *T. bellicosus*. The soldiers which accom-

pany the labourers and are found with them in their covered ways along the sills, floors and roofs of our houses, differ palpably in these respects from those of *T. bellicosus*. I made known my doubts on this point to my correspondent Mr. Westwood of London, proving the truth of my statement by specimens taken from my own dwellings, but, unfortunately, the bottles containing them were broken, and I failed of my object. I consider these *house-eaters* as the *T. arborum* of Smeathman. One of their nests, indeed, I found in the roof of my office, and by them great damage was done to the building; besides many books were destroyed, having been eaten through and through. Another nest also was found in a small out-building; the insects of these two nests corresponded to those found in my dwellings, &c., while marked differences existed between the latter and *T. bellicosus*. I regret exceedingly that the steps to prove this opinion have failed in the manner above stated. I hesitate not, however, to assert it, confirmed as it is by other observers.

Hills dissected.

Hill 1st.—Opened 22nd March, 1842. General outlines very much like those of a hay-stack; situated in a valley.

Measurement.

Circumference at base	34 ft.
„ at $\frac{2}{3}$ height from base	25 „
Height from apex to base on the surface . .	13 „
„ „ „ perpendicular	9 „

The work was begun with three men at 20 minutes past 4 P.M., and required $2\frac{1}{2}$ hours to accomplish it.

The material was red clay, obtained about two feet below the surface-soil, the latter being a mixture of sand and decayed vegetable matter brought down from the surrounding hills. The surface was highly indurated, receiving a slight impression from a single blow of the mattock.

The order first seen was the workers, who instantly retreated on exposure to the external air. They were succeeded by one and then another, and then many of the larger class of soldiers, who, rushing out in great rage with jaws extended, threatened vengeance on the intruders.

The experiment of permitting them to bite was tried several times, when it was perceived that a drop of brownish fluid was exuded upon the part. The sensation was like that of a minute sharp-cutting instrument, the jaws moving in cross direction like scissors.

On breaking several of the upward projections or “turrets,” they were perceived to be hollow, leading into the “dome,” and

the main passages in the walls down to the basement. These several passages were smooth, as if by being well-worn by constant tread, and it undoubtedly is through them that their food is brought from below to the "magazines." The first fragment of the hill exposed numerous apparent perforations, from the size of a shot to that of a dollar, which were increased by every stroke; these were the different passages, running in every direction and anastomosing with each other, keeping up a communication throughout the domicile.

The walls seemed to be about 12 inches thick, and contained numerous cavities or cells of various sizes and shapes, with young in different stages of growth, extremely white and delicate. They communicated with each other and with the main passages. The number of young contained in them varied from twelve to twenty. When several were found in one cell, they were regularly and closely packed, with their heads converging towards the bottom. The first idea which this arrangement presented to my mind, was that of pigs in an autumnal night, stowed in the angle of a "Virginia fence."

Having beaten away the wall of the hill, a layer of light brown spongy substance was seen, its structure irregularly cellular and inclosed in red moist clay of corresponding form; the "nurseries" of Smeathman. The cells contained young of different sizes; on the surface were visible numerous scattered minute white globular bodies, probably fungi. Messrs. Kirby and Spence suppose them to belong to the genus *Mucor*. But the *Mucorini* are generated from decayed animal and stercoraceous matter. Without a microscopic examination, they seem to me to be assigned more naturally to the *Trichocisti*, perhaps *Trichia*, the *pin-head fungi*, which are known to spring from decayed vegetable substance. It is highly probable that the material of which these nurseries are made is at base vegetable matter. Their extent, as thus observed, is from the base to two-thirds the height of the sides of the hill. Centrally to these, and lying immediately under the floor of the "dome," was a series of cellular work, entirely of clay, filled with a chestnut-brown substance, very moist, having the appearance of rasped or gnawed wood, and other vegetable matter. These are Smeathman's "magazines" and "food," which, with the nurseries, constitute almost two-thirds of the contents of the structure.

Throughout the nurseries were found young in different stages of growth: those in the external cells were smaller and mostly without rudimental wings; those in the interior cells were larger, with distinctly developed mandibles and rudimentary wings generally, the *pupæ* of *soldiers*. The young in the interior of this cellular work, with a few exceptions, were assuming the yellow

colour which marks the head and thorax of the workers and soldiers in their perfect or active state ; the exceptions were of a pure white.

As the larger passages were opened, a strong current of warm air from within was perceptible. I attempted to look down the "dome," but was compelled to withdraw immediately, my respiration being affected, and the glasses of my spectacles coated with a film of moisture ; a strong, peculiar, but not unpleasant odour was perceived. It was observed, that the deeper we penetrated, the more numerous became the young, and the more advanced were they in growth.

The structure called the "royal chamber" by Smeathman was discovered in a position central in respect to the circumference of the hill, and about 18 inches above the surface of the ground. Around and beneath it was a connected series of clayey cellular work, in which were found the young, as before stated. The *chamber* was of an oblong shape, rounded at the ends and sides ; flattened and thick above and below. It was supported on one side by two pillars about three-quarters of an inch in diameter ; on the other, it was attached to the surrounding clay-work. I accidentally broke open the inclosure, being misled by the statement of Smeathman, that it was situated on a level with the surface of the ground. The queen was discovered, surrounded by a large number of the larger labourers, a few soldiers, and some of the more advanced pupæ, all of whom were running rapidly round her, manifesting the greatest perturbation. The queen made great efforts at progression, constantly turning her head and thorax from side to side, but without moving in the least her huge abdomen. Her whole length was $4\frac{1}{2}$ inches. The king, evidently in great alarm, made repeated efforts to conceal himself under the abdominal folds of his consort.

On examining further the "royal chamber," a wide cavity was observed running horizontally along the upper part or roof, externally, but without any signs of communication with the interior. On the under surface of the roof, or ceiling, is a long depression, corresponding in shape to the body of the queen, which gives her that freedom of motion necessary to the extension of her eggs. This motion is compound, first in a longitudinal, then transverse direction, alternately elongating, contracting and widening her body, which is marked with short, thick, transverse bands. The skin is thrown into folds, while these bands operate as so many fixed points or centres of muscular action, forcing the eggs through their ducts to the place of exit.

For some time after exposure, the queen continued the expulsion of her eggs, but not, as I am inclined to think, to the usual extent. They were white and very minute, and left untouched

by the workers, who evidently continued in a state of the greatest alarm.

The floor of the chamber was perfectly plane and smooth, exhibiting not the slightest impression from the body of the queen. The roof in the centre was $\frac{3}{4}$ of an inch thick; the floor about $\frac{5}{8}$; at the line of conjunction about $\frac{1}{2}$. Posteriorly in the line of junction between the roof and floor was a small aperture, sheltered from above by a spur of clay running downwards, which was the only way discovered of ingress and egress. It could not have admitted an insect larger than the soldiers, and even to them, as it then appeared, it must have been a "strait gate." The king could not have passed, and, consequently, not the queen. It had the appearance of having been repeatedly closed and opened by collections of clay around it.

That the queen is inclosed for life, is evident from the fact that she is, from her great size, incapable of progression of herself, or of being transported by any means within the power of the community.

On clearing away the refuse at the base of the hill, the orifices of the main passages under the basement were discovered; descending in a sloping direction, they led to large vacant rooms, made by the pillars supporting the archwork, on which rests the interior of the structure. These pillars or columns were of an irregular, rounded shape, from $\frac{1}{2}$ to $2\frac{1}{2}$ inches in diameter, and stood on the solid ground about 6 inches high.

On visiting this hill the next morning, all the passages in that portion of the wall not dissected were found well closed with fresh deposits of clay, and also a continuous layer spread over the remaining central cellular work. This was done during the night by the surviving members of the community for their protection against the cool air of the night, the rain, and hostile insects.

The opening of a hill is the signal for the gathering of all their foes,—ants, reptiles, &c.; hence the speedy closing of their various entrances is a step of primary importance.

Another hill, previously dissected, was, after a time, so far repaired as to be externally perfect. On taking it down again, though the cellular work was apparently restored, no queen was found nor royal apartments; a few workers were all the insects discovered, and they were collected in the cells in the walls of the hill.

Hill 2nd.—Opened Feb. 3rd, 1847.

Circumference at base 26 ft. 10 in.

Height on the outer surface . . 8 „ 6 „

A diagonal section was made by a cross cut saw, beginning just below the upper floor of Smeathman.

The walls were much the thickest on the north side, nearly double those on the south, measuring $1\frac{1}{2}$ foot through.

It being in a locality where sand and gravel abounded, their materials were freely mixed with the clay.

The covered ways leading from the base to objects of plunder at a distance were in this case larger and more numerous than any I have seen before. The main one measured 12 inches in diameter, and gave off several branches which proceeded in various directions. These were traced to sticks, stumps and logs, which afforded them prey.

In this case the labourers in the hill were generally of the smaller class, while those in the covered ways and in the stumps were larger, having strong, stout jaws, well-adapted to the gnawing of wood. The "royal chamber" was found raised about $1\frac{1}{2}$ foot above the level of the ground.

Hill 3rd.—Circumference at base, 50 feet. Height, 14 feet.

The notes do not state whether this is the perpendicular height or not. Several fresh turrets were erected on the top, having a moist, deep red, granular appearance.

The structure called the "royal chamber" measured externally 10 inches in length, internally 8 inches. Its height from the level of the ground was 2 feet 8 inches. The length of the queen $4\frac{3}{4}$ inches.

Shrubs or small trees are frequently seen growing up through the hills. Such trees are never seen dead, consequently are not eaten by the insect.

XI.—On a supposed new species of *Glyceria*.

By FREDERICK TOWNSEND, B.A.*

IN 1846 I drew up a description of a supposed new species of *Glyceria*, which had probably been confounded with other described species, viz. *G. fluitans* and *G. plicata*; and a paper on the three plants was read before the Botanical Society of Edinburgh on November 9 in that year, but for the purpose of adding the results of further observations, it was not then published. Revised characters for, and some remarks upon, the three supposed species are now again submitted to the Society.

In my former paper I applied the name of *G. hybrida* to the new plant; but as the use of that word might lead to erroneous theoretical conclusions, I now substitute the name of *G. pedicellata*. The specific characters may stand as follows:—

1. *Glyceria fluitans* (R. Br.). Panicle simple, elongate, subsecund, spreading whilst in flower, otherwise close; branches

* Read before the Botanical Society of Edinburgh Dec. 13, 1849.

simple, lowermost mostly in pairs; rachis smooth; spikelets linear, of 7–12 acute florets; *outer pale oblong-lanceolate, length exceeding twice its breadth*: apex acute, somewhat apiculate; *anthers five times as long as broad*; *sheaths even*; careopsis linear-elliptical.

Var. β. Inflorescence spiked.

Rachis perfectly smooth, never swollen as in *G. plicata*. Leaves pungent; sheaths roughish; ligule obtuse, frequently obscurely three-toothed. Panicle subsecund, elongate; branches not bearing more than five spikelets, one branch only of each of the lowermost clusters bearing several spikelets; uppermost spikelets of the branches and rachis mostly sessile or upon short rigid pedicels; pedicels more or less scabrous. Inner pale equaling the outer in length or surpassing it. Anthers purple, sometimes yellow. Careopsis linear-elliptical.

It flowers from June to September, sometimes bearing a second crop late in the year, and is universally distributed. It grows in stagnant and running water.

2. *G. pedicellata*. Panicle simple, elongate, subsecund; branches simple, always spreading, lowermost mostly in threes; rachis smooth; spikelets linear, of 7–16 obtuse florets; *outer pale oblong, twice as long as broad*: apex entire or slightly and irregularly denticulate-crenate; *anthers three times as long as broad*; *sheaths sulcate*.

Rachis perfectly smooth, never swollen as in *G. plicata*. Leaves plicate, acute; sheaths roughish; ligule obtuse, somewhat apiculate. Panicle subsecund, elongate; branches not bearing more than six spikelets, one branch only of each of the lowermost clusters bearing several spikelets; spikelets more or less stalked; pedicels slender, flexible. Outer pale strongly ribbed when dry, more membranous than in the other two species; inner pale rather shorter than the outer. Squamulæ with an inflated appearance. Anthers always yellow; lips incurved after bursting. The careopsis has not been observed.

It flowers from June to September, and has been noticed in several places in Cambridgeshire, and at Dovedale near Blockley, Worcestershire. It is found in stagnant and running water.

3. *G. plicata* (Fries!). Panicle compound; branches compound, always spreading, lowermost mostly in fives, uppermost crowded; rachis scabrous above; spikelets linear, of 7–12 rather obtuse florets; *outer pale oval, not twice as long as broad*: apex obtuse-angled, obscurely three-toothed; *anthers twice as long as broad*; *sheaths sulcate*; careopsis roundish-elliptical.

Var. β. Panicle simple.

Rachis more or less rough from just below the panicle and

upwards, wavy and twisted above, and frequently with a swollen appearance. Leaves plicate, rather obtuse, more flaccid and of a darker green than in the other two species; sheaths sulcate, rough; ligule obtuse, apiculate, obscurely three-toothed or entire. Panicle often drooping, not so elongate as in either of the above; clusters arranged at shorter distances; branches often spreading in all directions from the twisting of the rachis, uppermost crowded, a single branch often bearing sixteen or more spikelets, two branches of each of the lowermost clusters bearing several spikelets; spikelets shorter than in either of the above, uppermost spikelets of the branches and rachis sessile or upon short rigid pedicels; pedicels always scabrous. Florets smaller than in either of the above. Inner pale rather shorter than the outer. Anthers purple, sometimes yellow. Careopsis roundish-elliptical, and at once distinguishable from that of *G. fluitans*, which is linear-elliptical.

It flowers from June to September, sometimes bearing a second crop late in the year, and is of frequent occurrence. It grows in stagnant and running water. This is the *G. plicata* (Fries), 'Herb. Normale Suec.' fasc. 5. No. 91, and is thus proved to be the plant described under that name by him.

Glyceria fluitans may at once be distinguished by its *even* sheaths, those of the other species under consideration being sulcate. *G. pedicellata* may be known from *G. plicata* by its spikelets being much longer and florets larger, its panicle simple and elongate, one branch only of each cluster bearing more than one spikelet, and the whole plant of a lighter green and more wire-like. A common observer might at a glance distinguish the plants by these characters.

The character of the inflorescence in *G. pedicellata* appears constant, whilst in the other plants it is variable, and for this reason I have noticed varieties derived from the form of inflorescence. By a compound panicle I understand that the main branches develop other branches upon which the *spikelets* are arranged, and the panicle is thus twice compound; in the simple panicle the pedicels of the spikelets spring directly from the main branches.

The name *pedicellata* has been chosen in consideration of the pedicels of the spikelets being longer and more decided in that plant than in the others, which have frequently quite sessile spikelets.

I have met with no description of *G. pedicellata*. From its having somewhat intermediate characters, it has probably been confounded both with *G. fluitans* and *G. plicata*. With regard to published figures, of which there are many, I will venture a few remarks. The figure given by Reichenbach (Icon. Fl. Germ.

vii. t. 79) is an excellent one of *G. plicata*; except the fruit, which is a tolerable representation of that of *G. fluitans*, as will be seen by reference to Nees von Esenbeck (Gen. Pl. Fl. Germ. Monocot. i. 57), whose figure of the fruit is exactly that of *G. plicata*; the rest of the plate by the latter author is not sufficiently accurate. By Parnell (Brit. Grasses, t. 45), as far as I can judge, a fair figure is given of *G. pedicellata*; and in Curtis (Fl. Lond. i. t. 18) also is to be found a good plate of the same plant: the form of the panicle is good; but the outer pale is too long, and the magnified representation still less accurate; the anthers and leaves are accordant. There only remains one other figure to be noticed, viz. that given in 'English Botany' (t. 1520); it is however so faulty that I can determine nothing with sufficient accuracy.

Since the above was forwarded to the Botanical Society at Edinburgh on Nov. 29th, 1849, some "Remarks on *G. fluitans* and *G. plicata*" have appeared in the 'Phytologist' (iii. 734) from the pen of Mr. W. H. Purchas, on whose paper I should wish to say a few words. In *G. fluitans* I have not myself observed any characters by which specimens with appressed branches may be distinguished from those with the branches divaricate; colour is the only distinction which Mr. Purchas has remarked, and of this he appears to speak only from recollection and to consider almost valueless.

G. plicata α . of the same paper is certainly my *G. pedicellata*; but these plants do not agree in the proportion of the outer pale; in the latter the outer pale is twice as long as broad, in the former it is less than twice as long as broad. The character taken from the position of the apex of the outer pale with respect to the floret next above (when first attempting to distinguish the plants) I thought might be of value, but afterwards determined it to be worthless. The plicature of the leaves may be found in all these plants, but not generally in *G. fluitans*, whilst in *G. pedicellata* and *G. plicata* I have found the plicature pretty constant. That a specimen from Mr. Moore agrees with this plant is possible, as the two latter plants possess some characters in common and were not then distinguished; but an original specimen from that botanist preserved in Mr. Babington's herbarium is the *G. plicata* of this paper.

The description of *G. plicata* β , which Mr. Purchas thought to be my plant, is that of *G. plicata* (Fries), with the exception of the proportion of the outer pale and the character given of the leaves. It is curious that Mr. Purchas should never have observed the leaves to be folded, as I have found them very constantly so, having examined plants from numerous localities in several countries. The panicle has truly a "fuller look," "from the greater number of compound branches," as well as from

their being arranged at shorter distances. The same botanist also observes, that "two branches of each whorl are almost constantly compound," and this character I have taken the liberty of inserting in other words in my observations on this plant. The remainder of his paper accords with my own observations, with exceptions which have been already noticed. I have however frequently found this plant in stagnant pools, and cannot as yet discover that either of the three affects peculiar situations.

There is only one more remark to be made, and this respecting the suspected hybrid origin of the plant; Mr. Purchas seems to imply that I held that opinion, but in my original but unpublished paper it was expressly stated that my convictions were that it could not be a hybrid, and the plant was therefore considered by me as a species; the unfortunate choice of a name has not unnaturally conveyed a wrong impression of my views.

XII.—*Supplementary Notes on British Odostomiæ.*

By J. G. JEFFREYS, F.R. & L.S.

SINCE the publication of my paper on this subject in the 'Annals of Natural History' for November 1848, the discoveries of that indefatigable conchologist Mr. Barlee, and the communications of other scientific friends, have induced me to notice the following additions of species and localities:—

Odostomia pallida var. *a.* Guernsey, Mr. Barlee.

Var. *b.* Loch Fyne, A. MacNab.

O. Rissoides var. *b.* Lerwick, Mr. Barlee.

O. alba var. *a.* This has been lately found by Mr. Alder on the coasts of Northumberland and the Isle of Man, and described by him in the Transactions of the Newcastle Naturalists' Club, under the name of *O. fulva*. It appears to attain a greater size than any other of the true *Odostomiæ*.

O. nitida monstr. Lerwick, Mr. Barlee.

O. albella var. *a.* minor, sutura profundiore. Lerwick, Mr. Barlee.

O. acuta. In this species, as well as *plicata* and *unidentata*, may be detected, by the aid of a good magnifying glass, faint but regular spiral striæ.

O. turrita. Birtabuy Bay, co. Galway, Mr. Barlee.

O. cylindrica. Lerwick, Mr. Barlee.

O. plicata var. *a.* Northumberland coast, Professor King. Guernsey; Burrow Island; Mr. Barlee.

O. unidentata. Arran Island and Birtabuy Bay, co. Galway; Burrow Island; Mr. Barlee.

O. conoidea var. *a*. Arran Island, co. Galway ; Guernsey ; Mr. Barlee.

O. diaphana. Lerwick, Mr. Barlee.

O. decorata (n. s.).

Testa ovato-oblonga, diaphana, nitida, alba, per dimidium inferiorem anfractûs cujusque striis impressis undulatis circa 15 sculpta ; anfractus 5, convexi, ultimo plusquam $\frac{2}{3}$ testæ æquante ; apex obtusus ; sutura subobliqua, profunde incisa ; apertura ovata, subtus rotundata, superne ad mediam anfractûs ultimi inflexa ; peristoma columellarem umbilicum includens ; plica inconspicua. Long. $\frac{1}{10}$, lat. $\frac{1}{13}$ unc.

Burrow Island, Mr. Bean and Mr. Barlee.

In my former paper I had confounded this species with *O. obliqua*, but am now satisfied of its distinctness, by reason of the spire being less oblique, the whorls more convex, the regular and close striæ on the lower half of each whorl, the absence of a fold on the pillar, and especially of the well-defined umbilicus. I received the species some years ago from Mr. Bean under the MS. name of *decorata* ; and as this name has been used by British conchologists, it may be inexpedient to change it for perhaps a more appropriate appellation. It differs from *O. diaphana* in its less cylindrical form and the greater convexity of its whorls, besides possessing spiral striæ and an umbilicus, which are wanting in the other species.

O. obliqua. Lerwick, Mr. Barlee.

O. insculpta. Dunvegan, Skye ; Oban ; Burrow Island ; Mr. Barlee.

O. truncatula (n. s.).

Testa oblongo-cylindrica, tenuis, nitida, alba, striis subtilibus spiraliter corrugata præsertim in anfractibus apicalibus, longitudinaliter ad suturam striis undulatis sculpta ; anfractus 6, convexiusculi, turriculati, sensim crescentes, primo velut exciso ; sutura obliqua, profunda ; apertura ovalis, superne in angulum contracta, subtus effusa ; peristoma fere continuum, postice replicatum ; umbilicus nullus ; denticulus conspicuus, plicæformis. Long. $\frac{2}{3}$, lat. $\frac{1}{10}$ unc.

Plymouth, very rare ; Mr. Barlee. I have only seen one adult specimen. This species has somewhat the form of "*Turbo subtruncatus*," Mont., which is the young of *Truncatella Montagu* ; and the specimens recorded by Montagu as having been found "in sand from Salcomb" may possibly be referable to it. It is however a true *Odostomia*, and differs in form and markings from any of its congeners. The animal appears to have a yellowish colour.

O. dolioliformis. Burrow Island ; west coast of Scotland ; Mr. Barlee.

O. spiralis. Burrow Island, Mr. Barlee.

O. interstincta. Burrow Island ; Bantry Bay ; Mr. Barlee.

Var. *a*. Guernsey, Mr. Barlee.

O. indistincta. Guernsey, Mr. Barlee.

O. excavata. Land's End, Mr. Barlee ; Exmouth, Mr. Clark, who notices that his specimen has "a strong conspicuous fold or tooth about the middle of the columella."

O. scalaris var. *a*. This is proposed to be distinguished by Messrs. Forbes and Hanley as the typical species, the name of *rufescens* being appropriated by them to the other species or variety. I however believe the latter to be only a northern form or variety.

O. lactea. Guernsey ; Burrow Island ; Mr. Barlee.

The variation of form in many of the species appears to be very considerable ; and it would be easy to add several others to the list.

XIII.—*Notes upon the smaller British Moths, with descriptions of some nondescript or imperfectly characterized species.* By JOHN CURTIS, Esq., F.L.S. &c.

Family TORTRICIDÆ.

1. Genus 946, 4^b*. *Tortrix* (*Ænectra*) *Pilleriana*, Hüb. pl. 27. f. 172 ♀, and *luteolana*, Hüb. pl. 21. f. 136, is a very variable species, and differs from the other *Tortrices* in the form of the palpi. Several specimens were taken by W. W. Saunders, Esq., at the back of the Isle of Wight. The larva lives principally upon the vine, and is very destructive in the vineyards of France, but it will feed also on *Stachys germanica*, and in the capsules of *Iris fœtidissima*, which abounds at Niton.

2. 28. *T. croceana*, Hüb. pl. 19. f. 120 ; *Modeeriana*, Haw. I took this rare species on 3rd July, 1842, on Bordean-hangers, near Petersfield, Hants.

3. Genus 947, 2. *Amphisa Walkerana*, Curt. Brit. Ent. pl. 209. In the summer of 1827 Mr. H. Walker took two males of this curious little moth near Lanark, which I described and published the following year, and he afterwards saw it flying in some abundance over heathy districts, the end of March, in the sunshine about noon, on Tinto, a hill near Lanark.

* As great confusion often arises for want of references to some accessible work, the numbers of the genera and species of Curtis's Guide, 2nd ed., have been added, as well as those of the 'Brit. Ent.'

On the authority of Zeller, Mr. Doubleday has changed my name for "*prodromana*," vide "Hüb. Caterpillars, *Tortrices* 4, Genuinæ B, c, fig. c," and on referring to the plate where the moth is figured with its wings closed, I am not satisfied that it represents my insect: it has simple antennæ, it is much lighter than any I have seen, and the shoulder-marks are different: nevertheless it may represent the female.

4. Genus 950, 23. *Spilonota tetragonana*, Step. I took a specimen 11th July, 1842, on a hedge bounding a wood going to Woolmer Forest from Selborn.

5. 26. *Spilonota sylvestrana*, Curt., was first discovered by Mr. Dale at Bournemouth, and from the 23rd June to the 1st July we found it there in 1846. It inhabits the Pinasters on the cliffs, and we beat it into our nets in the daytime. It has been distributed amongst entomologists by the name of "*duplana*" of Hübner, pl. 36. f. 229 & 230, to which it is not unlike, but much smaller: it also resembles the small dark varieties of *S. comitana*, Hüb.

It is gray: head grisly and crested; palpi horizontal, very scaly, second joint rhomboidal, apical not apparent; basal joint of antennæ stout; they are closely annulated with black: wings deflexed in repose; superior oblong, tip rounded; gray, transversely but irregularly striped with brown and chestnut, one-third of the base and a space towards the posterior margin darker, at the centre of this is a brownish-ochreous orbicular but not well-defined patch; the costa is spotted gray and dusky; the cilia are griseous with a black line at the base: under-wings pale golden-brown; cilia tinted, with a darker line: the under-side is of an uniform pale golden-brown, the costa slightly spotted: hinder tibiæ stout, with a pair of spurs below the middle, a little longer than the apical pair: expanse from 6 to $6\frac{3}{4}$ lines.

6. 27. *Spilonota (Sideria) achatana*, W.V.; *marmorana*, Hüb.; Curt. Brit. Ent. pl. 551. The 12th July, 1848, I beat four out of blackthorns by Pole Hill, near Uxbridge.

7. Genus 955, 5. *Anchylopera Lyellana*, Curt. Brit. Ent. fol. 376, having been first added to our British fauna by Sir Charles Lyell, who took it in June at Kinnordy in Forfarshire, I named it after my friend, but it seems to have been described previously by Treitschke under the name of *Phoxopteryx myrtillana*, and has been since figured by Duponchel, vol. x. pl. 253. f. 4.

8. 8. *A. diminutana*, Haw.; *cuspidana*, Treit. I have taken it the middle of August at Mickleham in Surrey, and Mr. Dale finds it at Lulworth in Dorsetshire.

9. Genus 957, 12. *Carpocapsa nigricana*, Haw. Our specimens do not agree with the Fabrician description, but Haworth's insect seems to be the *Grapholitha nebritana* of Treitschke, and is the "*Pisana*" of Guené, according to examples from Paris, which Mr. Doubleday obligingly showed me. This is a most interesting species, as it is the parent of the maggots in peas, which we have so long endeavoured to rear, but unsuccessfully.

10. 25. *C. Queketana*, Dale, was first discovered I believe on a bank going to Burkhams on the south side of the river the end of April 1842. I fear this name will fall, as Doubleday considers it the *T. fractifasciana* of Haworth, and the *Eriopsila caricana* of the continent.

11. Genus 959, 1. *Cnephasia bellana*, Curt. B. E. pl. 100. Immediately after a most successful entomological tour made in Scotland by Mr. Dale and myself, during the summer of 1825, I published this beautiful species, being one of the novelties I detected ascending Arthur's Seat. Nine years after it was described by Stephens as the *T. Penziana*?; *T. octomaculana*, Haw., being given as a variety. Wood of course followed in the same wake, and has consequently figured my new species as '*Penziana*,' and omitted to delineate '*octomaculana*,' which is distinct enough from *C. bellana*, but considerably like, if not identical with, Hübner's *Penziana*, pl. 14. fig. 85.

Here is one amongst hundreds of instances in which names have been changed and misapplied from either ignorance or caprice to the destruction of science, creating a mass of confusion, which it is to be hoped Mr. Henry Doubleday and Mr. Stainton will eventually set right.

12. 2. *C. octomaculana*, Haw. MSS., expands from 10 to 11 lines: it is pale fuscous: superior wings white or grayish-white with two irregular brown bands; the first near the base angulated, edged with black and not reaching the inner margin, second crossing the middle obliquely, very irregular, dotted with black, forming a kind of triangle on the costa united to a rhomboidal spot on the disc and detached from a smaller one on the inner margin; towards the apex is a spot leaving a pale patch on the costa, and a smaller one nearer the tip; towards the posterior margin are two or three irregular oblique lines of black dots.

Of this rare species, which has never been described, I caught two the 19th July, 1825, which flew out of a stone wall near the Inn at the base of Ben Lawes.

13. 3. *C. cretaceana*, Curt. It expands 10 lines, and is chalk-white: superior wings with very faint indications of spots and bands freckled with gray: inferior wings pale fuscous. I never

met with this insect but once, and then in abundance on the paling round Dover Castle in July 1829. I suspect it is only a strong variety of *C. octomaculana*, as some of my specimens approach that insect.

14. 10. *C. rectifasciana*, Haw. I am not satisfied that this is the insect figured by Hübner (pl. 38. f. 238) under the name of *T. hybridana*: it is larger and darker, and the markings have a different character; indeed it reminds me more of a variety of *T. comitana*.

Mr. Doubleday having applied my generic name to that portion of the group which is not typical, it becomes necessary to repeat, that the type of *Cnephasia* is a species abundant on elm-trees, the *T. logiana* of Haworth, which in 1826, when I established its characters, was believed to be synonymous with the Linnæan species, as well as with the *T. pascuana* of Hübner, pl. 16. f. 99. The name *Sciaphila*, which Mr. Doubleday has substituted for *Cnephasia*, was not published by Treitschke until 1829, and could not therefore be applied to my group, even had it not been preoccupied by Schönherr for a genus of Curculionidæ four years before Treitschke adopted it. It may be as well to correct the spelling of Hübner's name, which in his letterpress is *pascuana*, but by an error of the engraver the *s* has been converted into an *i*, making the unmeaning word *pasiuana*, and *pasivana* of Doubleday's list.

15. Genus 960, 1. *Orthotænia* (*Euchromia*, Step.) *formosana*, Curt. B. E. fol. 364. This was described by me in 1831, not as the *T. formosana* of Hübner as indicated by Mr. Doubleday, a species I am unacquainted with, as well as his *T. flammeana*, neither of which can I find in the Index to Hübner's works nor in Treitschke.

16. 13. *O. Arbutana*, Hüb. pl. 31. f. 195. Mr. Dale feels confident this is the *T. Arbutella* of the Linnæan cabinet.

17. 7. *O. alternana*, Curt. *ib.*: *Daleana*, Doub., was also described in 'Brit. Ent.' in 1831, where I adopted the names in the 1st ed. of my 'Guide,' and not of the 'Wiener Verzeichniss,' where I am unable to find *T. alternana*; and even if it be there, I must protest against the superseding of established specific names, unless the name has been employed in the same group previously. If such be the case in the present instance, I fully approve of the name of my friend, which Mr. Doubleday proposes.

18. 8. *O. gramineana*, Curt. *ib.*, also described on the above page of 'Brit. Ent.' At that time I stated it was "most allied
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to and the size of *O. cespitana*, Hüb.," an opinion which has recently been confirmed by Mr. Doubleday.

19. 9. *O. cespitana*, Curt. ib. Mr. Doubleday being satisfied that this is not Hübner's insect, but one described in the 'Isis' by Mad. Lienig as *T. palustrana*, my name must be transferred to the preceding species. I regret to see it separated from *Orthotænia* and made one of a new genus called *Mixodia* by Guené, for surely it cannot be necessary to form a genus to receive a species so closely allied to *O. cespitana*, that one may be mistaken for the other: sections are infinitely better, and to these we must come at last, when we have been overwhelmed with the burden of generic nomenclature. This extravagant rage for making genera has however had its use, having led to a refinement of discrimination which has been most beneficial in correcting the slovenly habits of investigation that attached even to the magistrates of the last century and somewhat later.

20. Genus 963, 6. *Cochylis marmoratana*, Curt. Brit. Ent. fol. 491. The species since described under the name of *luteolana* by Stephens, and figured by Wood, pl. 37. f. 1140, appears to be a variety of my *marmoratana*.

21. Genus 967. *Peronea*, Curt. Brit. Ent. fol. & pl. 16. Since this genus was published in 1824, prodigious strides have been made in entomology, and large quantities of these *Tortricidæ* have been bred by Mr. Doubleday, who considers a vast number of the species merely varieties of two types, viz. *T. cristana*, W. V., and *T. hastiana*, Linn. If Lepidoptera vary to such an extent, it may be well asked, 'What is a species?'

Family CRAMBIDÆ.

22. Genus 991^b. *Anerastia*, Zell.; *Abraxes*, Guide.

2. *Farrella*, Curt. Cab. Expanse 11 lines; and similar in form to *A. Marisci* or *T. lotella*, Hüb. pl. 48. f. 334. It is whitish, the horns are very slender and flesh-coloured, as well as the back of the thorax: superior wings narrower than in *lotella*, gray freckled with brown; the costa brown, with a white streak from the base to near the tip, and a suffused space of ochreous flesh-colour along the centre; before the middle, on the inner margin, is a black dot, and three more beyond the middle in a curve, one being on the costa, another on the inner edge of the white streak, and a third below it: inferior wings pale silky smoky lilac.

For a specimen of this pretty and distinct species I am indebted to Mr. H. F. Farr: two or three were taken at the North Lighthouse, Lowestoft, the beginning of June 1840.

23. Genus 993, 9^b. *Phycita bilineata*, Curt. Cab. It is the

size of *P. fusca*, Haw., but of a pale mouse-colour with a slight ochreous tinge, and the upper wings are narrower with a pale irregular transverse line, a little more than one-third from the base, but it does not seem to reach the costa, and there is an indistinct blackish dot on the disc: the under-wings are pale smoky with a nacreous silky surface: the antennæ are very slender and apparently simple, but it is a very old and imperfect male which I took when residing in Norfolk.

24. Genus 994, 6. *Eudorea Portlandica*, a name given to this moth by Mr. Dale, from his finding it only in the Isle of Portland. It seems to me to be the *E. phæolua*, described and figured in the Linn. Entom. vol. i. p. 306. No. 15. fig. 13.

25. 6^b. *E. concinnella*, Curt. Cab., expands 7 lines, being much smaller than *E. Mercurella*, Linn., which it most resembles: it is however entirely of a dark brown; nearly one-third from the base of the upper wings is a curved whitish striga, and intermediate between it and the shoulder is another; on the disc is an indistinct black Ω , beyond it an oblique white line, suddenly curved near the costa; a line of black dots at the base of the cilia, forming a little black spot near the middle, surrounded by gray scales, extending irregularly along the posterior margin: under-wings pale brown, whitish at the base.

I cannot remember where I took this distinct and unique specimen, unless it was at Bournemouth.

26. 8. *E. lineola*, Curt. Brit. Ent. fol. 170. It expands 8 lines, is white, head, palpi and thorax grisly; abdomen fuscous, edges of segments white: superior wings rather narrow, clouded with brown; the base is brown with an oblique black and white costal stripe, reaching only half across and forming on the costa, with the next, a white patch; this second line is white, very tortuous and margined with black externally; to the centre loop is attached a black oval spot; above it, but nearer the middle, is a small white dot in a black ring, and beyond it a black Ω , white in the centre; towards the hinder margin is an oblique sinuose white striga with a large curve, filled internally by a brown patch, and externally at the costa and opposite extremity are two other brown patches, the latter with a black arrow-head; these leave a semi-oval white space on the hinder margin, at the centre of which is a small brown spot bearing black pointed dots extending along the cilia, which is spotted black: under-wings fuscous-white, with a transverse pale sinuated line nearly parallel to the margin, as noticed in 'Brit. Ent.'—Wood's fig. 1446 is not good.

27. 9. *E. Resinea*, Haw. Lep. Brit. p. 499. Mr. Stephens having described this species under the above title in 1834, I

consider that it is quite unnecessary to disturb a name by which it was so well known, to admit one proposed by Guené, who in a letter calls it *delunella*. It was no doubt negligent of Haworth to transcribe Linnæus's characters of his *Tinea Resinella*, which he did with ?s, but as there is no such Linnæan insect as *Tinea Resinea*, no confusion can arise from retaining Haworth's and Stephens's name, by which it is identified in all our catalogues as well as by Wood's figure 1448, and an appropriate name it is, as the moth is always found on the trunks of Coniferæ.

28. 13. *E. angustea*, Curt. B. E. fol. 170, expands 7 lines. It is ashy-brown, the upper wings very narrow and gradually tapering to the base, towards which is an oblique broadish pale curved line, dark outside; on the disc are a minute oval and the usual Ω spots, but indistinct; and beyond them a very oblique sinuose pale narrow line well defined, the inner margin brown; base of the cilia gray with a line of black dots: under-wings pale yellowish-fuscous.

Wood's figure 1450 is not my *E. angustea*, but merely a variety of *E. Mercurella*. The only specimen I possess I caught in a damp cave at Tunbridge Wells the end of Aug. 1819, where I saw many more.

29. 14. *E. alpina*, Dale's MS. It expands 9 lines and may be only a large variety of the foregoing, but all the examples are paler, with an additional black oval spot below the minute one on the disc, and upon the under-wings is a pale transverse striga nearly parallel with the margin.

Mr. Dale's specimens were taken on Schichalion.

Family TINEIDÆ.

30. Genus 1008. *Depressaria*, Haw. ; Curt. Brit. Ent. fol. & pl. 221.

20. *D. bipunctosa*, Curt. Guide. It expands 11 lines and is whitish-ochre, the spaces between the marginal nervures of the upper wings are slightly fuscous, and on the disc of each are two distinct black dots, forming a longitudinal curved line, with another at the base, and the apex of the costa and posterior margin bear ten black spots: the under-wings are pale fuscous: antennæ and legs fuscous.

This is not a variety of Hübner's *T. Verbascella*, as I once suspected, and it certainly is not of any species I possess. It is the form of *D. liturella*, W. V., but is smaller, and at once distinguished by the colour of the legs, the uniform tint of the upper wings, with the dotted costa and darker under-wings. The only specimen I have seen was taken in the New Forest by Sir Charles Lyell about twenty years since.

31. Genus 1009. *Anacamptis*, Curt. Brit. Ent. fol. 189.

5. *A. lucidella*, Step.; *Cleodora lucidella*, Wood, pl. 40. f. 1240. This rare insect I found on some rushes near Newchurch in the Isle of Wight, the 1st of July, 1842, and Mr. Dale has taken it in the New Forest.

32. 26. *A. Lyellella*, Curt. It expands 6 lines and is cream-coloured: antennæ and legs mouse-colour, the latter spotted and striped with black externally: superior wings with three black costal spots, first a long one next the shoulder, a second at the centre, and a third further and larger; on the inner margin is an oblong patch, neither reaching the base nor the anal angle, yet extending more than midway to the costa; apex brownish with a black semicircle inclosing a dot at the tip: under-wings broad, suddenly pointed, pale fuscous and iridescent.

My specimen was taken by Sir C. Lyell the 9th of April in the New Forest.

33. Genus 1013. *Cleodora*, Step.; Curt. Brit. Ent. fol. 671.

6^b. *C. neuropterella*, Zell. This insect, which I supposed was the *T. falciformis* of Haworth, I took in Aug. at Mickleham. One of my specimens expands 11 lines: the upper wings are falcate, ochreous shaded to white on the interior margin; the nervures and spots between them are rosy-fuscous or mouse-colour.

34. Genus 1015. *Aphelosetia*, Step.?

6^b. *A. Inulella*, Curt. It expands 5 lines and is white: scales on head depressed; palpi recurved, scaly to the apex: superior wings narrow, lanceolate, ochreous, and freckled; costa, a line along the middle, with the radiating nervures and inferior margin white, and sometimes there is an oblique white stripe near the inner angle directed towards the tip; cilia long, pale, and dotted at the base: inferior wings silky dove-colour, nearly as broad as the superior, truncated at the extremity, the apex produced; cilia long and thick; hinder tibiæ stout, with hairy scales.

Very like *A. rufo-cinerea*, Haw., at first sight, but besides other differences, the under-wings are not lanceolate, which indicates an affinity to *Cleodora*. I bred two from flowers of *Inula dysenterica* the 28th of Aug. 1848, collected near Ryde in the Isle of Wight, and no doubt the caterpillars fed upon the seeds in the receptacles.

35. Genus 1017. *Damophila*, Curt. Brit. Ent. fol. 391.

3. *D. brevicornis* of Dale and the 'Guide' is the *Butalis æratella* of Zeller, Mr. Stainton informs me.

36. Genus 1021. *Pancalia*, Curt. Brit. Ent. fol. 304.

2. *P. fusco-cuprea*, Haw., I have taken at Podimore, near Sherborne in Dorset, the 8th of October.

3. *P. fusco-ænea*, Haw., is twice as large as the foregoing species. I have met with it the middle of August on the Downs near Lulworth, and also at Mickleham.

37. Genus 1023. *Microsetia*, Step.

4. *M. sericiella*, Haw. I found this little moth in abundance on the flowers of *Euphorbia amygdaloides* in Grovely Wood, near Wilton, the 9th May 1842.

Genus 1025. *Argyromyges*, Curt. Brit. Ent. fol. 284.

38. 1. *A. Autumnella*, Curt. B. E. pl. 284. This species is now decided to be the *T. Clerckella* of Linnæus, and the *A. Clerckella* of our cabinets is called *scitella*.

39. 1^b. *A. Acerfoliella*, Curt.; *Padifoliella*, Stain. The male expands 4 lines, and the antennæ are longer than the wings: it is sickly-white, superior wings very narrow, falcate, fuscous with a pure white stripe along the interior margin, surrounding a long oblique curved line at the anal angle; the apex attenuated, incurved, spotted black and white with a very black dot at the tip: inferior wings very narrow, smoky as well as the long cilia. The female is near 5 lines in expanse, fuscous; head and thorax white: superior wings very narrow, less falcate than in the male and terminating like a feather, rich brown, the interior margin pure white with the inner edge irregular, forming a square near the base, an oblique lobe at the middle, and a loop at the anal angle, inclosing a brown spot; the cilia of the apex is white with black crescents on the extremity of the costa and round the tip, where there is a black dot: inferior wings very narrow and tapering to a point.

For a pair of this rarity I am indebted to Mr. T. Desvignes, who took several in September and October flying out of maples and whitethorns in Whittlebury Forest. The sexes seem to vary considerably, but neither of them agrees with Hübner's figure of *T. Padifoliella*, pl. 46. f. 316, in which the costa is white and the interior margin spotted dark, whereas in our species it is exactly the reverse.

40. 16. *A. hortella*, Fab., I took in a plantation near Wands-worth the 19th of May.

41. 21. *A. Cydoniella*, Step., is the *lautella* of Heyden. I found a beautiful specimen in Muller's Copse at Glanville's Wootton the 18th May 1842.

42. 6^b. *A. maritima*, Stain. MS. The 26th of August, 1836, I first discovered this species on the banks of the river by St. Vincent's Rocks. It was tolerably plentiful.

43. 7. *A. obscurella*, Step. Ill. iv. 259. This insect occurs

amongst long grass in young plantations. I have taken it near Glanville's Wootton, Dorset, the 18th May.

Genus 1028. *Telea*, Step.

44. 2. *subfasciella*, Step. Ill. iv. 247. This I met with the 30th June at St. Martha's, near Guildford; the 9th July on Turk Mountain, near Killarney; and the 11th August at Mickleham.

45. 8. *Curtisella*, Don.; *cænobitella*, Hüb. It is now believed that the black *T. obscurella* of Hübner and the *T. picapennis* of Haworth are only dark varieties, but I have not seen any intermediate ones.

46. Genus 1030, 2. *Ypsolophus*, *Persicellus*, Haw., I find is not a variety of his *Y. bifasciatus*, the *T. sylvella* of Hübner; but a distinct species.

Genus 1031. *Cerostoma*, Lat.; Curt. Brit. Ent. fol. 420.

47. 4. *C. Xylostella*, Linn. I have a specimen expanding $7\frac{1}{2}$ lines, with the stripe on the inner margin of the upper wings nearly concolorous with the rest, but I believe it is only a variety of this common species.

48. 5. *C. Dalella*, Stain. Syst. Cat. p. 11. This species was first given to me many years since by Sir C. Lyell, who took it at Kinnordy, and the beginning of August 1825 I discovered it amongst heath on the face of a rock in the Isle of Bute. As it agreed pretty well with Hübner's fig. 164. pl. 24, I gave it as his *T. vittella* in my 'Guide.'

Genus 1031^b. *Acrolepia*, Curt. Brit. Ent. fol. & pl. 679.

This is a very remarkable group, so greatly resembling the *Tortricidæ*, that a careless observer, omitting to examine the palpi, would at once include it in the wrong family. In 1838 this genus was established in my 'Brit. Ent.' by dissection and elaborate definitions, and as Zeller did not publish the group until nearly two years after, his name and not mine must fall by the law of priority, which Mr. Stainton very justly recognises to its fullest extent.

49. 1. *A. autumnitella*, Curt. B. E. ib. I should not hesitate to adopt Mr. Stainton's opinion, that my species is the *Tortrix pygmæana* of Haworth's 'Lep. Brit.' p. 439, if he did not give 4 lines as the expanse of the wings, for my examples measure from $5\frac{1}{2}$ to $5\frac{3}{4}$ lines. Wood's figure 1136 of *Eupæcilia pygmæana*, as he calls it, after Stephens, is apparently identical with my insect, as well as Duponchel's *Hæmilis Lefebvriella* (v. 11. p. 141. pl. 290. f. 11). Since this genus was published in the 'Brit. Ent.' I have seen specimens of *A. autumnitella*, flying in the day-

time about rose-trees in my garden at Hayes, the beginning of April.

50. 2. *A. Betulatella*, Curt. B. E. pl. & fol. 679. The only specimens I have seen were taken by Mr. Dale off birch-trees at Castle Eden Dene the beginning of August 1837. I have however a new species to describe which I shall name

51. 3. *Marcidella*, Curt. Cab. It expands $6\frac{1}{2}$ lines, and is pale rusty-ochre : palpi recurved and tapering ; antennæ slender, white, and dotted ; head and back of thorax whitish : superior wings oblong, very much mottled, the costa arched and minutely spotted, with a dusky patch just beyond the middle, terminating internally in a longitudinal black line ; from the outer angle projects obliquely a short brown line, and at the centre of the posterior margin may be traced an imperfect ring inclosing two or three short black streaks on the nervures ; on the interior margin, before the middle, is a pale conical spot, with a dark margin next the base ; cilia fuscous with a dark line at the base and two little black lines at the tip, forming one or two white dots : inferior wings as broad as the superior, very pale mouse-colour, apex ovate-lanceolate.

A pair of this moth was given to me by Mr. Robertson I think : the specimens have a worn or faded appearance.

52. 6. *A. granitella*, Fischer, has been sent to me by Mr. Dale. It is allied to the genus *Cerostoma*.

Genus 1038. *Gracillaria*, Haw. ; Curt. Brit. Ent. fol. 479 ; *Ornix*, Treit.

53. 1. *G. Tavella*, Curt. Cab., expands $3\frac{1}{2}$ lines, and is similar to *O. Meleagripennella* of Hübner, but the wings are not so narrow, and a double white spot near the tip of the costa distinguishes it. It is white ; the hairs projecting from the forehead are brown : antennæ long and dotted : superior wings broad towards the apex, fuscous, with a lilac tinge at the extremity ; ten white semierescents ornament the costa, two at the apex nearly uniting and inclosing a black dot, which is bounded by black and white lines like a feather ; the fringe is white with a fine black line ; on the interior margin are two black spots, with white ones between them : inferior wings lanceolate and mouse-colour : abdomen fuscous spotted with white, the apex tufted in the male ; the organs of generation bright ochreous : legs white and spotted.

The 2nd June 1839, I beat a few specimens out of yew-trees at Mickleham.

Genus 1040. *Pterophorus*, Geoff. ; Curt. Brit. Ent. fol. 161.

54. 17. *P. similidactylus*, Curt., Dale. As neither Stephens's

description nor Wood's figure answers to my insect, I will add the characters of this species, which was unknown until I took three flying near the ground by a hedge at Niton, in the Isle of Wight, the 30th of July 1828.

It expands 1 inch and is yellowish-white : the superior wings are more or less freckled, deeply cleft, the upper lobe narrow and curved, the costa and inferior margins are tawny, forming an oblique line towards the extremity composed of two trigonate spots, that on the costa being the larger : inferior wings yellow-fuscous, divided into three rays, without any lobe on the abdominal one : legs white ; thighs and hinder tibiæ tawny, the latter tipped fuscous ; anterior tibiæ clavate and brown, except at the base, intermediate clubbed or tasseled with brown scales at the apex, and another similar tassel at the middle.

P. similidactylus varies in colour greatly, for one of my specimens is of an uniform dove-colour, except the darker markings on the upper wings, and the white but spotted legs. It is distinguished from the allied species by the narrow upper lobe of the superior wings and the tasseled spotted tibiæ.

18, Belitha Villas, Barnsbury Park, 1st Jan. 1850.

XIV.—*On Deposits of Diatomaceous Earth, found on the shores of Lough Mourne, County Antrim, with a record of species living in the waters of the Lake.* By the Rev. W. SMITH, F.L.S.

DURING a late visit to the North of Ireland I had placed in my hands, by Mr. J. M'Adam of Belfast, a small quantity of earth which from its peculiar appearance he fancied might contain the shells of "Infusoria." A very slight examination convinced me of the correctness of this conjecture, and proved that the entire substance of the earth in question consisted of a mass of unbroken or fragmental siliceous shells of various *Diatomaceæ*. Being desirous of ascertaining the exact nature of the deposit from which the earth had been procured, and how far it had claims to the character of "fossil," a term which has frequently, but I fear without sufficient consideration, been given to similar collections of these beautiful exuviæ, and understanding from Mr. M'Adam that the determination of the point would be of some importance as regarded a paper on the Geology of the district which he hoped in a short time to prepare for the 'Annals,' I determined to visit the spot, and record the particulars required from personal observation.

Lough Mourne is a sheet of fresh water of about two miles in circumference, lying amidst a range of low hills to the north-east of the town of Carrickfergus, at the distance of four miles from

that town, and about fifteen from Belfast. It occupies a basin in a plateau which does not appear to have any land of a much greater elevation in the immediate neighbourhood; the lake is therefore fed by the surface-drainage of a very small district, and has no further apparent sources of supply, with the exception of a spring at the north-west corner, the produce of which is of little importance. It is however worthy of note, that a small stream, sufficient to turn the wheel of a corn-mill in the neighbourhood, approaches within a few hundred yards of the lake, and falling into a natural pit or cavity, is lost to view, and is said to reappear at some distance southwards, and there unite its waters with those of the streamlet flowing from the lake, to whose larger mass it had thus fastidiously refused to contribute its supply. However this may be, it is certain that the lake itself is not subject to any serious disturbance from the sudden increase of its waters by floods or otherwise, and that its quiet depths and great purity are peculiarly favourable to the development of *Diatomaceæ*. The level of the water however appears to have been lowered to the extent of several feet by deepening the outlet from the lake, a course which seems to have been adopted in the hope of increasing the supply to a mill now in ruins, a fate not unnaturally the result of so reckless an expenditure of the capital represented by the waters of the natural reservoir, thus improvidently drained of its contents. The facts I have mentioned will account for the circumstances to which I proceed more particularly to refer, and which I noted during a brief survey of the shores of the lake in company with Mr. Geo. C. Hyndman and Mr. J. G. Smith on the 6th Sept. 1849.

On the north-east shore of the lake, at the height of about four or five feet from the present level of its waters, there occurred a stratum of diatomaceous earth corresponding with that alluded to in the opening of this paper. This layer was about six inches in depth and of great purity, containing but little foreign matter, and that chiefly the decayed filaments of the water-plants to which the living *Diatomaceæ* had been attached, or in company with which they had floated to their present position. This deposit when moist was of a dull gray colour, and resembled soft, freshly made soap; when placed upon the tongue, the taste was that of a smooth oleaginous substance. The sensation thus perceived is no doubt to be attributed to the extreme minuteness of the shells and their usually rounded outline, presenting no angles to grate upon the papillæ of the tongue or finger. When dried in mass, the earth is of a delicate cream-colour, when pulverized of a pure white, and forms, as I have proved, an excellent material for polishing silver plate. This layer must have required a long series of years for its gradual accumulation: its elevation from

the surface of the lake is accounted for by the lowering of the level of the waters before mentioned; and its position on the north-east shore is no doubt to be ascribed to the circumstance that south-west winds prevail at the season when the filaments to which the *Diatomaceæ* are attached, are loosened by the cold of autumn and winter.

At the present level of the water in the lake, near the spot where the layer now mentioned is found, there does not appear to be any fresh deposit of a similar character. This may possibly be owing to the more abrupt shelving of the bank, not affording a resting-place for the floating weeds; but on advancing towards the south and on the level strand of a little bay, there formed by a bend in the outline of the shore, a second deposit occurred evidently of a more recent formation. It was found covering the mud in a very thin stratum, and much more intermixed with earthy and other matters than the layer on the north-west shore. This layer is probably the result of accumulations made since the deepening of the outlet from the lake, and the date of this operation, and the comparative thickness of the layer itself, might possibly afford materials by which an estimate might be formed of the period occupied in the accumulation of the older deposit. The hurried nature of my visit did not permit me to make the inquiries necessary for such an investigation. No further deposits were found, nor were there any appearances of such on the western shore of the lake.

As important in determining the character of the deposits found, I made a gathering of such living *Diatomaceæ* as were within my reach, and I now subjoin a list of the species, discovered on a careful examination of all the collected materials, adhering throughout to the nomenclature of Kützing in his 'Bacillarien oder Diatomeen.' As a curious illustration of a "multum in parvo," I may mention that a drop which adheres to the point of a knife, dipped into water, holding the earth of the earlier deposit in suspension, will be found to contain nearly all the species mentioned below, and of some of these hundreds of individuals.

I have marked (†) those species which were found living in the lake; with one or two exceptions all the others were common to either deposit. In the older, or that from the north-east shore, the most conspicuous species and occurring in great abundance was *Surirella splendida*. The *Epithemiæ* were also exceedingly numerous. In the more recent deposit, *Surirella splendida* was in very small quantity, but its place was in some degree supplied by the beautiful *Melosira arenaria*, which I could not detect in the former. The *Epithemia*, which I have dedicated to one of my companions in a most agreeable excursion (whose reputation

as an acute observer in another department of natural history is not unknown to the readers of the 'Annals'), is a large and handsome species intermediate between *E. zebra* and *E. granulata*, but distinguished from both by its stouter habit, the regular convexity of its dorsal outline, and its rounded ends. I add a description in a note*.

† <i>Epithemia Musculus</i> .	† <i>Cocconema Cistula</i> .
†—— <i>zebra</i> .	† <i>Gomphonema acuminatum</i> .
†—— <i>ocellata</i> .	†—— <i>constrictum</i> .
†—— <i>gibba</i> .	—— <i>geminatum</i> .
†—— <i>turgida</i> .	† <i>Navicula nobilis</i> .
—— <i>granulata</i> .	†—— <i>major</i> .
—— <i>Hyndmanii</i> .	†—— <i>viridis</i> .
† <i>Himantidium pectinale</i> .	†—— <i>sphærophora</i> .
—— <i>Fragilaria virescens</i> .	†—— <i>radiosa</i> .
—— <i>capucina</i> .	—— <i>nodosa</i> β. <i>striata</i> .
† <i>Cyclotella operculata</i> .	—— <i>binodis</i> .
—— <i>minutula</i> .	—— <i>lata</i> .
† <i>Melosira orichalcea</i> .	—— <i>dicephala</i> .
†—— <i>arenaria</i> .	—— <i>mesolepta</i> .
—— <i>Campylodiscus noricus</i> .	†—— <i>elliptica</i> .
—— <i>Surirella splendida</i> .	—— <i>firma</i> .
†—— <i>bifrons</i> .	†—— <i>attenuata</i> .
†—— <i>Solea</i> .	† <i>Stauroneis Phœnicentron</i> .
†—— <i>elliptica</i> .	—— <i>punctata</i> .
† <i>Synedra capitata</i> .	—— <i>lanceolata</i> .
†—— <i>biceps</i> β. <i>recta</i> .	—— <i>cardinalis</i> .
†—— <i>ulna</i> .	†—— <i>lineolata</i> .
—— <i>sigmoidea</i> .	—— <i>amphicephala</i> .
† <i>Cocconeis Pediculus</i> .	—— <i>Platystoma</i> .
† <i>Cymbella Ehrenbergii</i> .	† <i>Amphora ovalis</i> .
—— <i>cuspidata</i> .	—— <i>Tabellaria fenestrata</i> .
† <i>Cocconema lanceolata</i> .	—— <i>ventricosa</i> .
†—— <i>cymbiformis</i> .	

It is evident from the above that neither of the deposits found can with strictness be termed fossil; that they are simply the siliceous coverings of species, the greater number, if not all, of which, still inhabit the waters of the lake, having required no doubt a lengthened period for their accumulation, but still one comparatively recent, and which cannot be regarded as conferring a fossiliferous character on the deposit itself.

In the 'Magazine of Nat. Hist.' for July 1839, an interesting description of an "Infusorial" earth found on draining Lough Island-Reavey, co. Down—is given by Dr. Drummond of Belfast: I have been enabled by the kindness of W. Thompson, Esq. of that town to compare this deposit with those I have here noticed. Although occurring under very similar circumstances,

* *Epithemia Hyndmanii*, W. Sm. *E. major*, a latere secundario valde et æqualiter convexa, apicibus obtusissimis rotundatis non recurvatis, striis transversalibus moniliformibus vix convergentibus: a latere primario oblonga medio valde dilatata. Long. $\frac{1}{300}$ — $\frac{1}{150}$ uncie.

and in a locality not very distant from mine, the earth from Lough Island-Reavey is almost wholly different, including but few species, and the more numerous of these found but sparingly in the Lough Mourne deposits.

The following make up nearly the entire mass of the earth described by Dr. Drummond:—

Navicula gracilis.
Himantidium arcus.
 — *pectinale*.

Tabellaria fenestrata.
 — *ventricosa*.

A few frustules of the following also occur:—

Surirella splendida.
Navicula viridis.

Epithemia zebra.
Cocconema lanceolata.

The profusion in which *N. gracilis*, *H. pectinale* and *T. fenestrata* occur in this deposit, would lead to the conclusion that the waters of the lake in which it had been found were the drainage of a subalpine district, whose surface was almost exclusively peat, while the Lough Mourne deposit would, even to the philomicros unacquainted with its locality, indicate the neighbourhood of clear springs, grassy pastures and a low elevation. In this way these minute organisms may afford matter for interesting speculation, and when occurring in a fossil state may possibly be made available in the researches of the geological inquirer.

Wareham, January 10, 1850.

XV.—*Notes on Chalcidites, and Descriptions of various new species.* By FRANCIS WALKER, F.L.S.

[Continued from vol. iii. p. 210.]

CAUDONIA, n. g.

Fem. Head and chest convex, very finely shagreened: head thick, a little broader than the chest: feelers slender, subclavate; first joint long, slender; second cup-shaped; third and fourth very small; the following from the fifth to the tenth successively but slightly decreasing in length and increasing in breadth; club long-elliptical, broader than the tenth joint, and more than twice its length: chest spindle-shaped, much developed: fore-chest rather long, having a slight transverse ridge near the hind-border whence it declines and grows narrower and forms a short neck: shield of the mid-chest very long; sutures of the parapsides distinct for rather more than two-thirds of the length of the chest, but thence quite obsolete; axillæ parted by rather less than one-fifth of the breadth of the chest; scutcheon nearly conical, with a slight transverse suture towards the hind-border; hind-scutcheon transverse, but rather large: hind-chest well developed, obconical, declining, with a ridge along the middle and a suture on each side: petiole short: abdomen long-oval, smooth, shining, slightly concave above, rather deeply keeled beneath, somewhat broader and a little shorter than the chest; metapodeon occu-

pying nearly one-fourth of the back; octoon and all the following segments of moderate size; the keel beneath forms an angle beyond one-half of its length, and thence rises abruptly to the tip, and emits the oviduct at about half its length between the angle and the tip: legs slender: wings of moderate size; ulna shorter than the humerus; radius full as long as the ulna; cubitus moderately long, full one-fourth of the length of the radius; brand small, round.—This genus is allied to *Trigonoderus*, *Hetroxys* and *Notanisus*.

Caudonia Agylla, fem. *Æneo-viridis, abdomine rufo basi cupreo apice viridi, antennis nigris, pedibus rufis, alis subfulvis.*

Head coppery: eyes and eyelets dark red: feelers black, shorter than the chest; first joint tawny, piceous at the tip: chest coppery green: front of the fore-chest almost black: hind-chest brassy: abdomen pale red, dark bronze-colour at the base above, green at the tip: oviduct tawny: legs pale red; four hinder feet tawny with piceous tips: wings pale tawny; veins darker tawny; brand pale brown. Length of the body $1\frac{1}{2}$ line; of the wings $2\frac{3}{4}$ lines.

England. In the collection of Mr. Dale.

Encyrtus Statius, fem. *Cyaneus, capite cupreo, abdomine nigro, antennis piceis albo-cinctis apice nigris, pedibus nigris, tarsis fulvis, alis nigro-fuscis.*

Head and chest convex: head coppery, large, most roughly punctured, hardly broader than the chest; crown and front very broad: eyes dark red: feelers subclavate, more than half the length of the chest; joints from the first to the sixth piceous; first joint long, slender, broader towards the tip; second cup-shaped; the following joints to the eighth slightly and successively decreasing in length; seventh and eighth joints white; club black, long-conical, broader than the eighth joint and more than twice its length: chest very short, a little longer than broad, dark blue, very finely punctured: fore-chest very short, but visible above: shield of the mid-chest short and broad; no traces of the sutures of the parapsides; axillæ long and narrow, just meeting on the back; scutcheon large, obconical, rather flat above, with a very slight furrow from the fore-border to the disc: hind-chest and petiole extremely short: abdomen triangular, flat, smooth, shining, black, shorter than the chest, but exceeding it in breadth near the base: legs stout, black; feet tawny with piceous tips; fore-feet darker than the rest; middle legs having the feet dilated as usual, and the tips of the shanks armed with two black spines: wings dark brown, somewhat dilated above the humerus; veins piceous; ulna not half the length of the humerus; radius and cubitus shorter than the ulna; brand extremely small. Length of the body $\frac{1}{2}$ line; of the wings $1\frac{1}{4}$ line.

England. In the collection of Mr. Dale.

Callimome eurynotus (Foerster MSS.), mas. *Viridis, abdomine purpureo basi cyaneo, antennis nigris, pedibus flavis, femoribus et metatibiis viridibus, alis limpidis.*

Head and chest convex, green, finely shagreened, rather thickly

pubescent: head hardly broader than the chest: eyes and eyelets red: feelers black, compact, rather stout, nearly filiform, clothed with yellow down, nearly as long as the chest; first joint long, slender, green; second cup-shaped, shining, not pubescent; third and fourth extremely minute; fifth and following joints nearly equal in length; club long-conical, rather more than twice the length of the preceding joint: chest long-elliptical: fore-chest rather long, narrower and rounded in front; its length rather more than half its breadth: shield of the mid-chest very long; sutures of the parapsides very strongly marked; axillæ parted by rather less than one-fourth of the breadth of the chest; scutcheon nearly rhomboidal, almost smooth at the tip, where it forms a ridge and thence declines very abruptly; hind-scutcheon short but distinct: hind-chest of moderate size, obconical, declining, nearly smooth: petiole very short: abdomen convex, spindle-shaped, smooth, shining, bright purple, rather hairy, bright blue at the base, narrower than the chest and but little more than half its length; metapodeon occupying about one-third of the back, concave at the base; its hind-border convex, and passing over the back of the octoon which is short; ennaton longer than the octoon; decaton longer than the ennaton; the three following segments shorter: sexual parts piceous, rather long: legs yellow; hips, thighs and hind-shanks green; trochanters and knees tawny; tips of feet brown: wings colourless, pubescent; veins brown; ulna full half the length of the humerus; radius rather more than one-third of the length of the ulna; cubitus very short, not more than one-third of the length of the radius; brand very small, forked, emitting a short branch. Length of the body $1\frac{1}{2}$ line; of the wings 3 lines.

Allied to *C. versicolor* and to *C. cyaneus*.

Prussia. In the British Museum.

Ormyrus cæruleus (Foerster MSS.), fem. *Viridi-cyaneus, purpureo et cupreo varius, antennis nigris, tarsis fulvis, proalis plerumque fuscis*.

Head finely shagreened, bright green, purplish blue on the crown, broader than the chest: eyes and eyelets red: feelers black, clavate, not longer than the chest; first joint long, slender; second cup-shaped; third and fourth very small; the following from the fifth to the tenth successively increasing in breadth, but hardly decreasing in length; club conical, broader than the tenth joint and about thrice its length: chest blue, nearly elliptical, very convex, shining, transversely rugulose, but appearing almost smooth, the marks being very slight: fore-chest very short; its length not more than one-eighth of its breadth: shield of the mid-chest large, roughly punctured, much broader than long; sutures of the parapsides indistinct; scutcheon obconical above, having a rim behind whence it declines abruptly and forms a right angle; axillæ parted by nearly one-third of the breadth of the chest: hind-chest transverse, rough, very short: petiole extremely short: abdomen long, obconical, convex, shining, rather hairy, especially towards the tip, finely punctured, denticulate and with rows of large punctures across each segment, smooth at

the base, tapering towards the tip, keeled beneath, about twice the length of the chest; metapodeon bright coppery green along the hind-border, rather less than one-fourth of the length of the abdomen; octoon coppery green, not half the length of the metapodeon; ennaton a little longer than the octoon, coppery, purplish blue at the base; decaton a little longer than the ennaton, with which it agrees in colour; protelum coppery, much shorter than the decaton; paratelum spindle-shaped, slightly compressed, much longer than the decaton; telum about half the length and breadth of the paratelum: oviduct springing from the base of the abdomen and reposing in a groove from thence to the tip: legs bluish green; shanks armed with two spines at their tips, those of the four hinder shanks long; trochanters piceous; knees and feet tawny; tips of the latter piceous: wings pubescent, but nearly naked at the base, and along two narrow lines which have a common source and pass along nearly the whole length of the wing; there is a large pale brown spot in the disc of each fore-wing beneath the ulna; veins piceous; ulna a little more than half the length of the humerus; radius about one-fourth of the length of the ulna; cubitus thick and extremely short, not half the length of the radius; brand none. Length of the body $1\frac{1}{2}$ line; of the wings 2 lines.

Prussia. In the British Museum.

Pachyneuron Pruni (Foerster MSS.), fem. *Viridi-cyaneus, abdomine angusto, antennis nigris, pedibus fulvis, mesotarsis et metatarsis flavis, alis limpidis.*

In structure like *P. formosum*: head and chest greenish blue, finely shagreened: feelers black: abdomen oval, smooth, shining, green or bluish green, depressed above, keeled beneath, much narrower but not longer than the chest: legs tawny; hips green; middle and hind feet yellow with piceous tips: wings colourless; veins piceous; ulna thick, less than half the length of the humerus; radius nearly twice the length of the ulna; cubitus as long as the ulna; brand small. Length of the body $\frac{1}{2}$ — $\frac{3}{4}$ line; of the wings $\frac{1}{2}$ — $1\frac{1}{2}$ line.

Prussia. In the British Museum.

Pteromalus laticeps (Foerster MSS.), fem. *Æneo-viridis, capite et scutello cyaneis, abdomine purpureo-cupreo, basi viridi, antennis nigris, pedibus flavis, femoribus protibiis et protarsis fulvis, alis limpidis.*

Head and chest convex, finely shagreened: head dark blue, a little broader than the chest: eyes and eyelets red: feelers pubescent, black, clavate, as long as the chest; first joint long, linear, bright pale yellow; second piceous, shining; third and fourth very small; the following joints from the fifth to the tenth successively increasing in breadth and decreasing in length; club conical, hardly broader than the tenth joint, but about twice its length: chest coppery green, nearly oval, narrower behind: fore-chest rather short, convex in front, concave behind; its length about one-fourth of its breadth: shield of the mid-chest broader than long; sutures of the parapsides

very indistinct; axillæ parted by nearly one-fourth of the breadth of the chest; scutcheon dark blue, truncate-conical, with a very indistinct transverse suture across the disc: hind-chest well developed, obconical, declining, somewhat excavated at the base, and having a ridge along the middle and a rim on each side: petiole very short: abdomen nearly oval, smooth, shining, purplish bronze, bright green at the base, flat above, keeled beneath, slightly tapering at the tip, narrower and much shorter than the chest; metapodeon conical, convex till near its tip, occupying nearly one-fourth of the length of the back; octoon not half the length of the metapodeon; each of the four following segments as long as the octoon; telum narrow, somewhat longer; the abdomen forms a very obtuse angle in the middle of the underside: legs tawny; four hinder legs with bright pale yellow shanks and feet, tips of the latter piceous: wings colourless, pubescent; veins tawny; ulna full half the length of the humerus; radius longer than the ulna; cubitus rather more than half the length of the ulna, slightly curved; brands very small. Length of the body $1\frac{3}{4}$ line; of the wings $3\frac{1}{4}$ lines.

Prussia. In the British Museum.

Smiera Ampyx, fem. Ferruginea, pedibus flavis, alis limpidis.

Tawny: feelers linear, rather longer than the chest: mouth yellow: petiole as long as the abdomen, which is elliptical, smooth, shining, slightly compressed, much shorter and narrower than the chest: fore-legs and middle-legs yellow: hind-coxæ large, armed above toward their tips with a few small teeth; hind-thighs dilated, beset with a row of small teeth along the underside, and armed with a larger tooth at the base: shanks curved, fitted to the thighs, each ending in a spine: wings colourless; veins piceous; a small brown spot on the stigma. Length of the body $1\frac{1}{4}$ line; of the wings 2 lines.

West Indies. In Mr. Clear's collection.

Smiera Fidius, fem. Rufa, nigro flavoque varia, antennis nigris, alis limpidis.

Red: head finely punctured; front and underside yellow: eyes and eyelets pale red: jaws curved, each armed with three short brown teeth: feelers linear, black, somewhat piceous beneath, as long as the chest; first joint long, slender, yellow, black at the tip: thorax roughly punctured; sides marked with yellow: breast mostly black: a black line passes along the back of the scutum of the mesothorax: metathorax black: petiole short: abdomen obconical, downy, shining, very finely punctured, black towards the tip, narrower and a little longer than the chest: fore-legs and middle-legs bright yellow; hind-coxæ yellow, tinged with red above, and each having a black spot on the outside; hind-thighs red, each armed beneath with a row of small teeth along the lower edge, and having a larger tooth at the base: hind-shanks curved and applied to the thighs, yellow towards the base which is black, having a black band across the middle, reddish at the tips which are produced into spines: hind-feet yellow, their tips piceous: wings colourless; veins piceous; ulna above half

the length of the humerus; radius a little longer than the ulna; cubitus short, hardly one-fourth of the length of the radius, with which it forms a very acute angle; stigma very small. Length of the body $2\frac{1}{4}$ lines; of the wings 3 lines.

West Indies. In Mr. Clear's collection.

Smiera Pratinas, mas. *Rufa, nigro varia, antennis nigris, pedibus nigro flavoque variis, alis fuscis.*

Bright red: head and chest roughly punctured: crown of the head black; a spot of the same colour along the lower edge of the eye: fore-chest with a large black spot on its back, and a smaller spot on each side; there is also a small black spot on each of the epimera of the middle chest: petiole long: abdomen smooth, shining, short, broad not nearly so long as the chest: feelers black, nearly linear, as long as the chest; first joint rather broad, red at the base, forming a very obtuse angle beneath; second and third joints very short; fourth and following joints of moderate size, hairy, closely joined together, and successively decreasing in length; tenth and three following joints yellow: fore-legs and middle-legs simple, hairy; hips and thighs red, the latter tinged with black; shanks black with yellow tips; feet yellow; the joints successively decreasing in length till the fifth, which is somewhat longer than the fourth: hind-legs red; hips large, obclavate, black towards the tips, and that especially on the upper side; thighs very large, compressed-oval, armed beneath with about twelve small teeth; shanks dark red, black at the base and towards the tips, curved and fitted to the thighs: wings dark brown; veins pitch-colour. Length of the body 2 lines; of the wings 4 lines.

West Indies. In Mr. Clear's collection.

Chalcis Resus, fem. *Nigra, pedibus flavis, metafemoribus nigro vittatis, alis sublimpidis.*

Black: head and thorax dull, punctured, clothed with bright yellow hairs, especially at the tip of the scutellum: abdomen smooth, shining, clothed above with a few hairs: antennæ black: legs yellow; hind-thighs black on the inside and having a large spot of the same colour on the outside, armed beneath with eight small black teeth, and having also one larger yellow tooth near the base: wings nearly colourless or slightly tinged with brown; squamulæ yellow; veins piceous, paler towards the base of the wings. Length of the body 3 lines; of the wings 5 lines.

Sierra Leone. In Mr. Clear's collection.

Palmon Idomene, mas et fem. *Cyaneo-viridis, abdomine æneo aut purpureo, subtu fulvo, oviductu corporis longitudine, antennis pedibusque flavis, metapedibus purpureo-fulvis, alis sublimpidis.*

Male. Head and chest scaly: head green, hardly broader than the chest which is bluish green: eyes and eyelets red: abdomen obclavate, slender, flat, bronze-colour, tawny beneath towards the base, nearly as long as the chest: feelers subclavate, yellow, less than half the length of the body; first joint long, slender, linear; second cup-

shaped; third and fourth very minute; fifth and following joints subquadrate, of moderate size, successively but slightly decreasing in length; eleventh, twelfth and thirteenth joints forming an oval club which is broader than the tenth joint and more than twice its length: legs yellow; fore-legs and middle-legs of moderate size; fore-feet having the first joint long and dilated, the second, third and fourth very small, the fifth longer; middle-feet with the first joint dilated and very long; the second large, but smaller than the first; the third, fourth and fifth very short: hind-legs tawny, tinged excepting the feet with bluish purple; hips very long; thighs very large, compressed-oval, armed on the inside with several teeth, rather less dilated than those of the female; shanks curved and fitted to the inside of the thighs; first and second joints of feet dilated, second much shorter than the first; third, fourth and fifth pale yellow, very small; claws and foot-cushions black: wings rather narrow; fore-wings slightly tinged with brown; veins tawny; humerus long; ulna much shorter; radius about one-third of the length of the ulna; cubitus much shorter than the radius; stigma very small.

Female. Abdomen purple, compressed, nearly as long as the chest, tawny and keeled beneath; the keel increasing in depth from the base to the tip: oviduct and its sheaths yellow and as long as the body: thighs and hind-hips tinged with bluish purple; feet simple, first joint long, second and following joints very small. Length of the body $1\frac{1}{4}$ – $1\frac{1}{2}$ line; of the wings $2\frac{1}{2}$ lines.

Sierra Leone. In Mr. Clear's collection.

Urolepis Cychreus, mas. Cupreus, antennis fulvis, pedibus rufescentibus, alis immaculatis.

Copper-colour: head and chest convex, very minutely shagreened: head a little broader than the chest: eyes and eyelets piceous; the latter near together on the crown of the head, the middle one a very little in advance of the other two: front green, slightly impressed: feelers tawny, nearly filiform, rather shorter than the chest; first joint long, slightly curved; second long cup-shaped; third and fourth very small; fifth and five following joints of moderate and nearly equal size; eleventh, twelfth and thirteenth joints forming a long conical club, which is twice the length of the tenth joint: chest large: fore-chest short, narrower in front: scutum of the middle-chest broad; sutures of the parapsides indistinct, especially towards the hind-border where they approach each other; axillæ large, separated by rather less than one-third of the breadth of the scutum; scutellum nearly hexagonal, with a transverse line near its hind-border: hind-chest large, obconical, slightly declining, having a ridge down the middle and one on each side, whereby it is divided into two compartments; it is rugulose on the outer sides of the compartments, on the tip of whose middle ridge there is a shield-shaped protuberance: petiole very short: abdomen nearly round, smooth, shining, slightly convex, a little more than half the length of the chest; first segment large, its disc hollow; second large; third and following

segments short : legs dull red ; feet pale red, their tips brown : wings ample, tinged with tawny colour ; veins tawny ; ulna hardly half the length of the humerus ; radius longer than the ulna ; cubitus much shorter than the ulna ; stigma small, brown. Length of the body $1\frac{1}{4}$ line ; of the wings $2\frac{1}{4}$ lines.

"Found on the edge of the pond in the Zoological Gardens, Phoenix Park, Dublin (in September), where *Notiphila cinerea* and *Ephydra littoralis* (or *coarctata*) were abundant. Perhaps a parasite of the latter, as *Ur. maritimus* is of *Ephydra riparia*." Haliday MSS.

In the collection of Mr. Haliday.

Panstenon Pidius, mas. *Cyaneo-viridis, abdominis disco purpureo-cupreo, antennis fulvis, pedibus flavis, alis perangustis.*

Body bluish green, very long and narrow : head and chest scaly : head much broader than the chest ; front impressed : feelers tawny, slender, filiform, inserted in the front, nearly half the length of the body ; first joint long and rather stout ; second stout and cup-shaped ; third and fourth hardly visible ; fifth and following joints small, nearly equal in size ; eleventh, twelfth and thirteenth forming a spindle-shaped club about twice the length of the tenth joint : chest spindle-shaped : fore-chest short : scutum of the middle-chest rather long ; sutures of the parapsides not distinct ; scutellum obconical, of moderate size : hind-chest large, subquadrate, hardly declining : petiole yellow, nearly one-sixth of the length of the abdomen, which is spindle-shaped and somewhat shorter than the chest ; disc purplish copper ; segments of moderate size, slightly decreasing towards the tip : legs pale yellow, long and slender ; middle-feet and hind-feet pale straw-colour ; tips of the feet tawny : wings extremely narrow, with a slight yellow tinge, more or less shorter than the body ; veins yellow ; ulna much shorter than the humerus ; radius shorter than the ulna ; cubitus of moderate length ; stigma small. Length of the body $\frac{3}{4}$ line ; of the wings $\frac{3}{4}$ -1 line.

Distinguished from *P. Oxylus* by its much narrower wings and by other characters.

Ireland. In Mr. Haliday's collection.

Panstenon Oxylus, reared by Mr. Haliday from the pupa of a Dipterous insect (*Agromyza Pisi*, Kalténbach) on the pea.

Prosopon montanum.—*Female*. Head and chest brassy green, covered with fine scales : feelers black, clavate, twelve-jointed, about one-third of the length of the body ; first joint long, rather slender, tawny beneath and at the base ; second cup-shaped ; third very short ; fourth and following joints short, closely joined together, successively but slightly decreasing in length ; tenth, eleventh and twelfth joints forming an elliptical club which is broader than the ninth joint and more than thrice its length : abdomen smooth, purple varied with green and copper colour on the sides and at the tip, somewhat elliptical, nearly flat above, slightly keeled beneath, a little broader and longer than the chest ; first segment short, convex along the hind-border ; second rather longer, also convex on the hind-border ; third

short, with a straight hind-border; fourth, fifth and sixth of moderate size, with straight hind-borders; seventh extremely small: middle-legs not dilated.

In other characters it resembles the male.

Found by Mr. Haliday with the ♂ on mountain heaths near Belfast, both pretty common.

Ericydnus Æmnestus, fem. *Viridis, antennis nigris, abdomine basi pedibusque rufis, alis vix ullis.*

Head and chest dark green, shining, convex, very finely shagreened: head broader than the chest; crown large; front convex: eyes and eyelets dark red: feelers black, clavate, much shorter than the body; first joint long, slender; second long cup-shaped; third and following joints to the ninth successively shorter and broader; tenth, eleventh and twelfth joints forming a spindle-shaped club which is more than twice the length of the ninth joint: chest elliptical: fore-chest short, narrower in front: scutum of the middle-chest short and broad; scutellum obconical: abdomen sessile, convex, dark green, obconical, pale red towards the base, narrower and much shorter than the chest; there are a few hairs towards the tip which is deeply keeled beneath: legs pale red; middle legs dilated as usual, their shanks armed with long spines; hind-shanks rather dark; tips of the feet brown: wings rudimentary. Length of the body $\frac{2}{3}$ line. *E. strigosus* ♀?

Ireland. In Mr. Haliday's collection.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Feb. 27, 1849.—William Yarrell, Esq., Vice-President, in the Chair.

The following papers were read:—

1. DESCRIPTION OF TWO NEW SPECIES OF CYPRÆA.

By JOHN S. GASKOIN.

CYPRÆA CRIBELLUM. *Cyp. testâ subcylindricâ, lævi, albâ, bruneo omnino obtectâ, præter maculis numerosis, testâ concoloribus, ferè circularibus, inæqualibus et irregulariter dispensatis; marginibus bruneo-rufescente punctatis; basi subplanulatâ, albâ; aperturâ latâ, præcipuè anticè; columellâ ventricosiusculâ; dentibus labii prominentibus, æqualibus, circa quindecim; dentibus columellaribus subobsoletis (præter dente primo) circa duodecim; dente primo majus prominente deinde anticè est incisura profunda; sulco columellari nullo, extremitatibus anticis leviter productis, externè valdè convergente; canali lato et profundo; extremitatibus posticis obtusis; canali postico lato, aperturâ rectè continuo; margine externo incrassato; spirâ latè umbilicatâ.*

Shell subcylindrical, smooth, white, covered by a dark-brown coating except at numerous nearly circular white spots, of unequal sizes and irregular distribution, thus leaving at those spots the colour of the

shell to view; the line of meeting of the two mantles of the mollusc on the dorsum is generally perceptible; internally of a brown colour; outer edge of the margin more or less dotted with rather large dark reddish-brown dots, similar dottings, but less in degree, on the columellar side of the base; base rather flat, white (white deposit, on the centre of the columellar side, semitransparent); aperture wide, especially anteriorly, inner edge of the lip spiral; columella slightly ventricose; teeth on the lip prominent, even, extending partly on to the base, about fifteen in number, those on the columella very slightly prominent (excepting the first), not extending on the base,—about twelve in number; the first greatly projects, between which and the inner anterior extremity is a deep notch,—no columellar groove,—and at the posterior half of the aperture the teeth exist along the outer, those on the inner edge being mere indications of teeth; extremities, anterior very slightly produced, the outer one converging greatly; posterior extremities obtuse, very slightly produced; channels, anterior wide and deep, posterior rather wide and in a straight line with the aperture; margin, only on the outer side, incrassated; spire widely umbilicated.

Long, $\frac{1}{2}\frac{4}{10}$ of an inch; wide, $\frac{2}{10}$ of an inch.

Hab. Mediterranean Sea.

Cab. Gaskoin, Saul, &c.

This species differs from *Cypræa Cribraria* of Linn. in the general conformation of the shell, being more cylindrical, in its short, obtuse extremities, its wide aperture, particularly anteriorly, the large dottings on the margin, the character of the teeth, the internal colour of the shell, &c.

CYPRÆÆ PULICIS VARIETAS. *Cyp. testâ longiore, dentibus numerosioribus minutioribusque, supra labrum circa viginti-novem, supra columellam circa viginti-tribus; canali postico denticulato.*

Shell longer in form, of a light reddish-brown colour, aperture narrower and straighter, teeth finer and much more numerous than the ordinary form, being about twenty-nine on the lip, while the prototype has about nineteen, and on the columella side, about twenty-three, against from fourteen to seventeen; posterior channel more or less denticulated.

Hab. —?

Cab. Cuming, Gaskoin.

2. DESCRIPTION OF A NEW SPECIES OF NUTCRACKER.

BY JOHN GOULD, F.R.S. ETC.

NUCIFRAGA MULTIPUNCTATA, Gould.

Crown of the head and nape of the neck brownish black; feathers of the face, sides of the neck, back, chest and abdomen brownish black, with a broad and conspicuous mark of dull white down the centre; wings glossy greenish black, the coverts and secondaries with a lengthened triangular mark of white at the tip, a faint trace of a similar mark appearing on the tips of the primaries; tail glossy greenish black, the two centre feathers slightly, the next on each side more

largely, and the remaining three extensively tipped with white, the extent of the white increasing as the feathers recede from the centre; under tail-coverts white; upper tail-coverts and thighs striated with white.

Total length, $14\frac{1}{4}$ inches; bill, $1\frac{7}{8}$; wing, $8\frac{3}{4}$; tail, 7; tarsi, $1\frac{5}{8}$.

This species exceeds in size both the *N. caryocatactes* and *N. hemispila*, but at the same time has a smaller and more slender bill than either of those birds; it also differs from both of them in its lengthened and cuneiform tail; it has a greater quantity of white on the apical portion of the tail-feathers than the European species, but less than is found in the *N. hemispila*; the white markings of the back and the entire under surface are also much larger and more numerous than in either of the other species, and are most remarkably developed on the scapularies.

The only specimen I have seen of this fine species is in the Museum of the Philosophical Society at York; its precise habitat is unknown, but as other species which were certainly from Simla in India accompanied it, we may reasonably conclude it was from that country.

3. NOTES ON THE DISSECTION OF THE PARADOXURUS TYPUS, AND OF DIPUS ÆGYPTIUS. BY H. N. TURNER, JUN.

Having received, through the liberality of the Society, a few of the animals that have died in the menagerie in the course of the present winter, I feel bound to lay before them, as well as I may be able, whatever details of structure I observe which may be new, or may give rise to ideas calculated to assist in the advancement of the science. Since the Society have done me the honour to insert in their Proceedings* the somewhat lengthened communication which I was last permitted to lay before them, I hope that the remarks I have now to offer, some of which have a bearing on the same subject, may also prove acceptable.

It formed part of my object in that paper to demonstrate that the Viverrine group, (of which the Paradoxuri are now universally admitted to form a part,) are so closely allied to the Cats as to safely warrant their being united with them in one family, instead of being looked upon as a section intermediate to the canine and feline groups, or, on account of their number of tuberculous molars, more closely allied to the former, in which light they have very frequently been considered: and I think it will be apparent, from the observations I have now to bring forward, that the genus *Paradoxurus*, one of the least exclusively carnivorous of the order, and formerly associated with the Bears in the plantigrade division, has a much closer relationship with the group, which, from its being pre-eminently carnivorous, is usually considered as "typical" of the order, than naturalists have been wont to anticipate. It is not unfrequently the case, that when an affinity between two species or genera is established upon essential peculiarities of structure, certain minor details, or even habits and actions of the animal, remind one so forcibly of the relationship we

* See also vol. iii. p. 397 of this Journal.

have already proved to exist, that they assume an unlooked-for degree of interest; and, having kept for some time a living specimen of the common *Paradoxurus*, I think a few of the observations I have made upon it may on this account be interesting, in connection with the structural peculiarities which the receipt of a dead one has enabled me to remark.

The claws are as retractile as in the domestic Cat, although from the absence of the long and soft hair, with which the sides of the toes are clothed in the latter animal, they are fully exposed when in the retracted position. But on examining the claws of the *Paradoxure*, it becomes obvious that the raising of the point from the ground is not the only means employed by Nature to maintain their sharpness. Every one must have observed in the common Cat, as well as in the larger species preserved in our menageries, the habit of occasionally scratching or dragging with the claws against the surface of any hard substance, a process not apparently calculated to improve their sharpness, but obviously intended to aid the shelling off of the outer layer of the claw, which is continually renewed by growth from the root, and the blunted point is thus occasionally replaced by a new one. I have not observed this habit in the living *Paradoxurus*; but on examining the claws of the dead one, I noticed that some of them were much larger than others, these being worn and blunted at the point, while the smaller ones were sharp; also that the series of claws on each foot were irregular as to their sizes, and that the corresponding claws on the opposite feet in some cases differed greatly in size; so that it would appear, that in the absence of the scratching propensity, the claws scale off naturally, and to a much larger extent at a time than in the Cats. I have occasionally noticed my living specimen with a claw apparently loose, but the casting off of the outer layer of the nail is a difficult thing to verify by actual observation.

On one occasion, my specimen having escaped from his cage, on my seizing him by the neck for the purpose of replacing him therein, he made use of his claws to defend himself, just as a cat would naturally be expected to do; while it is well known that any animal of the dog tribe, being seized in that manner, is helpless, having no instinct prompting him to make use of his extremities against his captor; in this tribe also the paws are never used for seizing, but only for the purposes of locomotion, and to steady the prey upon the ground, while the teeth perform their office. The positions sometimes assumed by the *Paradoxurus* in a state of repose, also resemble those of the cat; for instance, it frequently lowers the body between the fore-paws, approximating the shoulder to the foot, while the elbow remains raised by the side: the canine animals, on the other hand, *never* crouch without applying the elbow to the ground. The *Paradoxurus* again resembles the Cat in the habit of occasionally bending the head vertically beneath the neck while asleep, a position never assumed by the Dog.

In all the anatomical characters which in my former communication I assigned to the *Felidæ* (in which family the viverrine section is included), the *Paradoxurus* fully agrees; those presented by the gene-

rative and odoriferous organs are the most remarkable. There is no true musk-bag, simply the two seecrning pouches situated one on each side the anus, which are so common among the carnivora. In addition to these, there is at the base of the prepuce, an oval, flat, naked space, which is not simply a secreting surface, as stated by Mr. Gray in a paper contributed to the Proceedings a few years back, but contains a number of minute orifices, each opening into a somewhat cylindrical glandular sac: these are arranged vertically side by side, and, together with the anal pouches, secrete the substance which imparts to the animal its characteristic odour. The generative organs are altogether very largely developed; the prostate is large, of a slightly lobulated form, and the urethra passes obliquely through its centre. Cowper's glands, whose presence is characteristic of the Felidæ, are remarkably large, causing a prominence externally posterior to the scrotum; and, as usual in the family, each is surrounded by a powerful muscular envelope, which is at least an eighth of an inch in thickness; the fibres converge to a tendinous portion, which extends, from the point where the duct issues, some distance on each side of the gland; the size of these organs altogether is about equal to that of the testes. The length of the penis, from the orifices of Cowper's duct to the meatus urinarius, is a little more than three inches; it is perfectly flexible in every part, and therefore the os penis must be either very minute or wanting; this is another feline character, since in the Bears and Weasels, as well as in the Dogs, the bone forms a considerable part of the organ. The glans is cylindrical, it tapers a little for about six-tenths of an inch, then terminates suddenly in a small conical point, in the groove around the base of which is situated at the lower part the urethral orifice. The body of the glans has a slight median groove beneath, and its whole surface is covered with horny spines directed backwards. Cuvier, who alludes to a similar peculiarity in the Cats, makes no mention of it, either in the *Ichneumon*, the *Civet*, or the *Hyæna*. Its existence is therefore an interesting mark of affinity between two genera apparently so dissimilar, although, from its inconstancy, it will not serve as a character of the family. In the *Paradoxurus* the spines are minute, very numerous, and regularly distributed*.

The same organs in the *Jerboa* present some peculiarities worthy of notice. I will observe, in addition to what has before been described, that Cowper's glands are each curved upon itself in a manner similar to the *vesiculæ seminales*. The two sharp-pointed bony stylets with which the upper part of the glans is armed, and which have been mentioned by authors, arise about the middle of the dorsum of the glans, one on each side of a prominence of its substance; they are

* Since the above was written, I have received the body of a male *Coatimondi*. I alluded to that animal in my former paper, as being placed by Cuvier among the list of those possessing the *vesiculæ seminales*, which, I observed, required confirmation. I can now assert that they do not exist; the walls of the *vasa deferentia* are swollen immediately before these vessels enter the urethra, and the prostate has a more sudden projection at its upper end than I have observed in the musteline animals that I have dissected. The absence of the *vesiculæ seminales* is then a constant character of the true *Carnivora*.

gently curved, and rather suddenly pointed at the end. In the recumbent condition they incline a little towards each other, just overhanging the extremity of the glans, and bear some resemblance to the pointed lower incisors of some small Rodent. The glans itself appears tripartite at the extremity, there being a deep fissure running the whole length of its under surface, and just at the extremity another on each side : at the meeting-point of the fissures is the urethral orifice. Just behind the origin of the bony stylets the presence of a small ossicle can be distinctly felt within the substance of the glans.

A very remarkable peculiarity in this little animal is, that amidst the long white hairs which clothe the lower part of the foot is a small sharp horny spike, situated just below the base of the middle toe, as if it were intended to enter the ground, and thus prevent the animal from slipping when it alights. This I have reason to believe is not generally known, although it must I think be alluded to by Dr. Shaw in his General Zoology, since he there remarks, "There is also a very small spur or back-toe, with its corresponding claw : " and subsequently adds, "nor does any vestige of it appear in the figure given by Dr. Pallas of the skeleton." This may well be, since it is simply a cutaneous development, having no connection with the skeleton whatever. I have looked at the specimens of the Jerboa in the British Museum, but in consequence of their being dried and mounted, the little appendage, which is concealed by the hair, was not to be perceived ; but in the *Alactaga*, as well as the same circumstances would permit, I could see that a little horny process existed, but was rough and blunt.

In the dissection of an animal whose only mode of progression consists of leaping with the hinder extremities, and which differs from the other jumping Mammalia in the circumstance, that in the position of rest the extremity only of the metatarsus is applied to the ground, the muscles of the leg may be expected to afford some points of interest. The most striking of these are, that none of the muscles situated upon the tibia remain fleshy for more than about half the length of that bone, each terminating in a long tendon ; and that upon the foot itself there are no muscles whatever, the actions of the flexors of the toes being relieved by a strong ligament, which arises from the os calcis, and divides into five, giving one to the middle toe, two small sesamoid bones being developed in it ; and two divisions to each of the other toes, the index and the annularis, each of which has also its sesamoid bones, those furthest from the axis of the foot being rather largely developed, extending some distance over the sides of the articulation. The ligament near its origin contains three little supernumerary bones, one on the outer, two on the inner side ; the latter are grooved for the passage of the tendon of the flexor perforans. On the homology of this tendon I have next to remark. It might very naturally be expected, that in animals having no thumb on the hinder extremity, and in which the fibula is in great part wanting, the flexor longus pollicis, which in man has its origin in the fibula, would be either much reduced or absent ; but so far from such being the case, it will be seen, on reference to any work on the comparative anatomy of the muscular system, that this muscle exists, and that its tendon

becomes entirely confluent with that of the flexor longus digitorum. But further, I think it will appear that in those lower Mammalia, in which the thumb or the fibula, or both, are wanting or imperfectly developed, it is the flexor longus digitorum that is reduced in size, and the flexor longus pollicis that becomes the principal muscle acting on the toes. The dissection of the Jerboa made this homology very evident. The large flexor muscle which gives the perforating tendons to the toes arises, as may be expected, partly from the tibia as well as from the fibula; but it is distinctly shown to be the flexor longus pollicis, from the fact that its tendon passes through a distinct sheath, separate from and posterior to that which contains the tendons of the other two muscles, namely the flexor longus digitorum and the tibialis posticus. Of these, which are both very small, the former shows its homology most clearly, by arising from the surface of the tibia, immediately below the insertion of the popliteus. The tibialis posticus is an extremely minute and delicate muscle, arising only from the tibia.

In the Rabbit the two perforating flexors form a single muscle, having the proper origins of both; lower down they become to a certain extent separable, but the tendons are completely reunited *before* they pass the ankle, which they do in the place belonging to the flexor longus pollicis. This compound muscle, occupying the whole posterior surface of the bones of the leg, so pushes round the tibialis posticus, that it takes the chief part of its origin from the inner side of the tibia, which in Mammalia generally is free from muscular attachment. In the Paradoxurus I found that the flexor longus digitorum has, in addition to its usual attachments, a point of origin in the head of the fibula; but then the bones are separate, and the flexor longus pollicis is a distinct muscle, having also origin in both bones, and each tendon passes the ankle in its usual place*.

March 13.—W. Yarrell, Esq., Vice-President, in the Chair.

The following papers were read:—

1. NOTICE OF A PECULIARITY OF STRUCTURE OBSERVED IN THE AORTA OF THE WILD SWAN. BY JOHN DAVY, M.D., F.R.S. L. & E., INSPECTOR-GENERAL OF ARMY HOSPITALS, ETC. (COMMUNICATED BY MR. GULLIVER.)

When engaged in examining anatomically this bird (a full-grown female, killed in the neighbourhood of Chatham in February 1839), my attention was arrested by a peculiar appearance in the inferior

* Since writing the above I have taken opportunities of looking at the same muscles in a Fox and in a Monkey (*Cercopithecus pygerythrus*). The former animal differed from the Paradoxurus, and resembled the Jerboa, in the great extent of the flexor longus pollicis and the much-reduced size of the tibialis posticus, which here also terminates in a long slender tendon, showing an interesting correspondence of *adaptive* character in two animals, in which the motion of the hind-limbs is vigorous, but of one kind only. In the Monkey the flexor longus pollicis is a much larger muscle than the flexor longus digitorum, and has considerable attachment to the tibia.

Meckel and Cuvier allude to the union of the two long flexors in the Rabbit before they pass the ankle, but neither author informs us at which point that takes place.

portion of its aorta, which I shall briefly describe with the hope of leading to further inquiry. Before the ischiatic arteries are given off, the aorta is comparatively large and is enveloped externally in a dense fibrous coat, possessing very little elasticity: below the origin of these arteries, the trunk of the aorta suddenly becomes small, and continues small and tapering to its termination; and this change is accompanied with an alteration in the structure of its external coat. In place of a dense fibrous envelope, it is now sheathed in a substance very like muscular fibre, and which from its properties I believe to be a muscular layer. It is of some thickness, of a reddish hue, slightly elastic, easily broken, and divided by a ligature and easily separated into longitudinal fibres of considerable length. Under the microscope each filament appears to be composed of nearly parallel fibres of extreme delicacy, and destitute of those peculiar markings which belong to the fibres of the voluntary muscles generally and to some of the involuntary. Moreover, when placed in a warm damp atmosphere, at a temperature between 80° and 90° Fahr., it rapidly putrefies and is reduced to a poultaceous or semifluid consistence. These properties seem to characterize it as a muscular structure; I would not dwell on any one in particular, but rather on the assemblage of them. An attempt of late has been made to revive the old doctrine of the muscularity of the middle coat of the arteries, founded almost exclusively on microscopical appearances. The structure described above, I consider not of the nature of the middle arterial coat, believing that that coat is not truly muscular, but rather of the nature of the muscular coat of the intestines, to which, in point of colour, consistence, the effect of a ligature, its microscopical appearance and proneness to putrefy, it is so very similar.

If this structure be admitted to be muscular, it may be viewed as accessory and of a use similar to that of the accessory hearts of the *Chimæra* and *Torpedo*, and destined to some peculiarity of function which further research is required to determine.

Before concluding this notice, I may mention incidentally that I availed myself of the opportunity afforded by this Swan to examine the air contained in its osseous air-cells. I found it to be composed of about 83·3 per cent. azote, and of 16·7 per cent. oxygen, tested by means of lime-water and phosphorus. It was collected from the cells belonging to the cervical vertebræ,—cells by means of which this part of the bird is happily buoyant, floating in water, even when deprived of its feathers and integuments and detached from the trachea. And, further, I may mention, which was new to me, that its large intestine is almost as amply provided with villi as its small; and that even the isthmus or narrow neck of each of its large cæca is similarly provided with villi. Some other animals, especially birds, may be analogous in this respect; but in no other instance in which I have yet examined the large intestines in search of villi have I found them.

2. NOTES ON THE SKULL OF *EQUUS HEMIONUS* AND *EQUUS KIANG*. BY J. E. GRAY, ESQ., F.R.S.

Mr. Hodgson has lately sent to the British Museum three specimens of the Horse, which he had described under the name of *Equus*

Kiang; unfortunately they were so destroyed by insects during their passage from India, that it was impossible to preserve any part of them except the skull and the bones of the limbs.

As a doubt had arisen as to the distinction of this species from the *Hemione*, *Equus Hemionus*, of Kutch, I have compared these skulls with the skull of the latter belonging to an imperfect skeleton, which was kindly presented to the Museum, with the skin, by the Earl of Derby, from an animal which lived some time in Knowsley Park.

The forehead of all the three specimens of *E. Kiang* is rather convex between the eyes, and the centre of the face is narrow and keeled on the sides; while in the skull of *E. Hemionus* the forehead is flat between the eyes, and the centre line of the face is rather broader and rounded gradually off on the sides, and the incisive bone is longer and more gradually arched, making the incisor more perpendicular in the latter than in any of the former.

But the most distinctive character between the four skulls is in the position of the infraorbital foramen. In *E. Hemionus* it is high up, about one-third the space between the face-line and the back edge of the teeth; it is far back, being directly over the front end of the cheek-ridge and the back edge of the third grinder: while in all the three specimens of the skulls of *E. Kiang* this foramen is lower down, being nearly in the centre of the space between the face-line and the base of the teeth, and it is placed in a line over the back edge of the second grinder, some distance in front of the end of the cheek-ridge.

The under surface of the body of the posterior sphenoid is narrow and convex in *E. Hemionus*, and broad and flat in *E. Kiang*. The vomer is much more compressed in the latter than in the *E. Hemionus*.

I am not certain that the distinctions here described may be sufficient to show that these two animals are separate species, but they indicate the necessity of the subject being more fully examined.

In the position of the suborbital foramen the *E. Kiang* more nearly resembles the *E. asinus*, and the *E. Hemionus* that of *E. Zebra* and *E. Burchellii*.

Two of the skulls of the *E. Kiang* show the small rudimentary grinder in front of the other; but this tooth is to be more or less distinctly observed in the skulls of the other *Equidae* in the Museum collection. I may observe, that in the skull of *Equus Burchellii* in the British Museum collection, this tooth is placed on the inner side of the first true grinder.

3. DESCRIPTION OF THE ANIMAL OF TRIGONIA, FROM ACTUAL DISSECTION. BY G. HUXLEY, ESQ., R.N., WITH AN INTRODUCTORY NOTE BY PROFESSOR E. FORBES, F.R.S. ETC. ETC.

The accompanying account of the animal of *Trigonia* was forwarded to me by Mr. Huxley, Assistant-Surgeon to the Rattlesnake, now surveying in the Eastern and Australian Seas, under the able command and scientific zeal of Capt. Owen Stanley.

The great number, beauty and geological importance of the species

of this interesting genus have made especially valuable a knowledge of the structure of its animal. Quoy and Gaimard were the first to give any account of it, and a figure and description of the animal of *Trigonia* were published from their drawings and notes in the zoological division of the Voyage of the *Astrolabe**. Since then I am not aware of this curious creature having been re-observed, though much has been written respecting its systematic position. As in such a case a verification of the evidence we possess, through a new and accurate set of observations, is of almost as much importance as the description of an unobserved animal, the Zoological Society may consider Mr. Huxley's notes in the light of a valuable contribution to malacology.

Both accounts confirm the idea suggested by the shell of its position among the *Arcaceæ*, and its close affinity with *Nucula* and *Arca*. The degree of union of the mantle-lobes, and the development of siphonal tubes in this family, as among the neighbouring *Mytilidæ*, is of generic and not sectional significance.

I add the description of the animal given by the French naturalists for comparison:—

“L'animal a le manteau ouvert dans les trois quarts de sa circonférence inférieure. Il est frangé sur ses bords, avec de petites taches ou lunules blanches qui alternent avec des stries rayonnées. On voit, au sommet de ce manteau, les impressions denticulées de la charnière, et en avant et en arrière, les muscles qui unissent les valves. Le pied est grand, robuste, sécuriforme, très recourbé en arrière, tranchant et denticulé sur son arête, de chaque côté de laquelle sont des laciniures, au tiers antérieur seulement. Il ne nous a pas paru se dilater comme dans les muscles. Les branchies sont grandes, libres, subtriangulaires, en pointe, reposant, de chaque côté de la racine du pied, leur doubles lamelles. Les palpes buccaux sont excessivement petits, réunis dans une partie de leur étendue. L'anus est à l'extrémité d'un court pédicule. La disposition du manteau et le manque de tubes rapprochent ce mollusque de celui des *Nucules*, dont il diffère cependant par la disposition des branchies et la brièveté des appendices de la bouche.”

Description of Trigonia.

The mantle-lobes are rounded and plaited, to correspond with the ribs of the shell. The edges of the mantle are marked with white spots; posteriorly, opposite the anus they are provided with short convex appendages. The mantle-lobes are disunited throughout, not joining until they reach the upper surface of the posterior adductor, some distance above the anus.

The gills are somewhat triangular, extending backwards almost horizontally on each side of the visceral mass. Each gill is formed of three stems, fixed at one extremity, free and pointed at the other, and giving attachment throughout their whole length, on one side to depending filaments, which become shorter as they are more posterior.

* Vol. iii. p. 476, Mollusques, pl. 78. f. 5.

The filaments are formed of a tubular horny thread, supporting on one side a broad membranous fringe. I could perceive no trace of vessels in this fringe, but it appeared to be covered by an epithelium (ciliated?).

The mouth is placed at the anterior and superior part of the animal, between two thickish horizontal lips. The labial tentacles are two on each side, rather long, lanceolate, and slightly pectinated. The anus is placed posteriorly and superiorly between the gills, and just about the posterior adductor muscle.

The so-called "foot" is composed of two portions, an upper and quadrilateral (properly the abdomen), and a lower pointed part (the true foot), the two being set at right angles to one another.

The first portion is sharp-edged and slightly pectinated posteriorly, marked by a groove bounded by two folded lips anteriorly. The second portion is slightly pectinated along its lower edge, pointed anteriorly, prolonged behind into a curved process, where it joins the superior portion.

Visceral mass.—The mouth opens by a very short œsophagus into a wide pyriform stomach, surrounded by a dark dendritic liver. The stomach narrows into a long intestine, which descends for the whole length of the abdomen, and forms one or two loops in the substance of the generative gland; then passes up again above the stomach, penetrates the heart, and passing between the two small lateral muscles of the foot, terminates in the anus.

BOTANICAL SOCIETY OF EDINBURGH.

December 13, 1849.—Dr. Lowe in the Chair.

The following communications were read:—

1. "On the Plants of the Valley of Fatana, Taheite," by Archibald Sibbald, M.D., R.N. The author gave a list of the species observed by him in the Valley of Fatana, in Taheite, with their native names, and remarks on their properties, and the uses to which they are applied by the inhabitants. The paper was accompanied by specimens of the "Tapa" cloth, and an account of the mode in which it is prepared from the bark of the bread-fruit-tree, *Artocarpus incisa*.

Mr. M'Nab exhibited a book containing specimens of native cloths collected during Captain Cook's voyages among the South Sea Islands.

2. "On some Scotch Freshwater Algæ," by Wyville T. C. Thomson, Esq. The author laid before the Meeting specimens of freshwater Algæ, collected during the past summer chiefly in the west of Scotland. Of the genus *Batrachospermum*, specimens of *B. atrum* were exhibited, of a very large size, found in Ayrshire during the month of October. Mr. Thomson remarked, that the supposed rarity of this species probably originated in its being sought for at the wrong season; he had found it sparingly during the early part of the summer attached to stones at the bottom of still, clear pools, the specimens being usually about an inch or an inch and a half high. When found in the end of autumn, however, the plants were free, floating on the surface of the water or attached to the ice. At this

time the specimens occupy, when laid out, a space from six to nine inches in diameter. Specimens were also exhibited of *B. moniliforme*, *stagnale* and *proliferum* from Ayrshire, the latter two being considered by Mr. Thomson as forms of the first depending on situation.

Mr. Thomson corroborated Mr. Berkeley's observations on the capsular fructification of *Chaetophora tuberculosa*, and exhibited a series of specimens connecting this species with *C. elegans*, of which he considered it the mature state, enlarging, softening, and breaking down, by the imbibition of water, for the escape of the spores from its ripe capsules. He exhibited a number of other beautiful specimens of freshwater Algæ.

3. "On peculiar Cells found in the Style and other parts of certain species of *Grevillea*, *Banksia*, *Manglesia*, and other *Proteaceæ*," by Spencer Cobbold, Esq. The author mentioned the occurrence, in the stem, leaves, floral envelopes, and fruit of various *Proteaceæ*, of certain peculiar cells, which in their simplest stage of development are transparent, fusiform, and of variable size, but generally much larger than the cells composing all other tissues of the same organ, and containing in their interior cellules of various colours, and a nucleus attached to or bulging out from the cell-wall. He considered that whatever be the function of these bodies, there is one special end to which they seem destined, viz. the formation of peltate hairs, which occur in great abundance over nearly all the organs of some of the species examined.

4. "On the Plants used for forming Hedges and Fences in Southern India," by H. Cleghorn, M.D., H.E.I.C.S. The author adverted to the remarkable prevalence of thorny shrubs and prickly plants in the flora of the Peninsula; where they are a continual annoyance to the traveller, and a frequent cause of admission into hospital—especially during the hotter months, when the leaves having dropped off, the spines are left bare and exposed. Notwithstanding the abundant provision for the extensive diffusion of hedges and fences, it is universally admitted that the bleak and barren tracts stand pre-eminently in need of these appliances, for the development and preservation of their agricultural resources, which suffer from the depredations of wild animals and stray cattle.

He exhibited drawings of *Opuntia Dillenii*, Haw., prickly pear; *Agave cantula*, Rox., aloe (with a sample of its fibres used for cordage); *Euphorbia tirucalli*, L., milk bush, and *E. antiquorum*, L. These, with the bamboo, are commonly employed in the enclosures of Southern India.

Cæsalpinia sepiaria, Rox., Mysore thorn, is invested with historical interest, Hyder Ali having encircled the village fortifications with this plant. The fences are handsome and almost impenetrable. This, with *Pterolobium lacerans*, R. Br., and other species, seems worthy of general introduction, and grows rapidly from seeds. *Cupparis sepiaria*, L., forms an excellent hedge round Shikarpoor. *Trophis aspera*, Retz., is well adapted for the same purpose from its ramous branches and rigid character. *Acacia latronum*, Willd., was also pointed out, aptly designated by Willdenow *Frutex horridissimus*.

This paper will appear in the 'Annals of Natural History' and in the Transactions of the Society.

Dr. Cleghorn exhibited the fruit of *Aristolochia indica*, L., and the strange-looking tuberculated pod of *Bignonia xylocarpa*, Rox., three feet long—about the size of a walking-stick. When pendulous from the tree, it is a conspicuous object on the Malabar Ghauts.

5. "On a supposed new species of *Glyceria*," by Frederick Townsend, B.A. (See p. 104.)

The following office-bearers were elected for the ensuing year:—

President.—Professor Fleming.

Vice-Presidents.—Dr. Neill, Dr. Lowe, Professor Balfour, Dr. Seller.

Councillors.—Mr. Lawson, jun. ; Mr. Wm. Ivory, W.S. ; Dr. Parnell ; Mr. James Cunningham, W.S. ; Mr. J. T. Syme ; Professor Christison ; Professor Goodsir ; Mr. Charles Murchison ; Mr. J. S. Sanderson ; Mr. Benjamin Carrington.

Treasurer.—Mr. Brand.

Honorary Secretary.—Dr. Greville.

Foreign Secretary.—Dr. Douglas MacLagan.

Assistant Secretary.—Mr. Evans.

Curator of Museum.—Mr. Wyville T. C. Thomson.

Artist.—Mr. J. M'Nab.

Assistant Curator.—Mr. G. Lawson.

Jan. 10, 1850.—Professor Fleming, President, in the Chair.

Many donations were announced.

The following papers were read:—

1. "On the British species of *Chara*," by Charles C. Babington, M.A., F.L.S. &c. (See p. 81.)

2. "On the Watery Secretion of the Ice-plant, *Mesembryanthemum crystallinum*, L.," by Dr. Augustus Voelcker, Professor of Chemistry in the Royal Agricultural College, Cirencester. (This paper will appear in our next Number.)

3. "List of Plants found in the Island of Rathlin," by Miss C. Gage. The picturesque and interesting island of Rathlin or Raghery is situated on the coast of Antrim, being three miles distant from the promontory of Fair Head, on the mainland, and nearly five and a half miles from Ballycastle. In its geological formation it is basaltic, and presents fine cliffs, with some remarkable columns, more especially at Doon point on the south-eastern side. Among the plants noticed were the following:—*Galium pusillum*, *Anagallis tenella*, *Beta maritima*, *Cuscuta epilinum*, *Helosciadium nodiflorum*, *Cicuta virosa*, *Conium maculatum*, *Cenanthe fistulosa*, *Smyrniolum Olusatrum*, *Scilla verna*, *Alisma ranunculoides*, *Elatine hexandra*, *Sedum reflexum*, *S. Rhodiola*, *Nymphæa alba*, *Nuphar lutea*, *Ranunculus hirsutus*, *Orobanche major*, *Draba muralis*, *Crambe maritima*, *Brassica oleracea*, *Raphanus maritimus*, *Lavatera arborea*, *Ulex nanus* (introduced), *Hypericum Androsæmum*, *Artemisia maritima*, *Inula Helenium*, *I. dysenterica*, *Pyrethrum maritimum*, *Malaxis paludosa*, *Littorella*

lacustris, *Eriocaulon septangulare*, *Ceratophyllum demersum*, and *Asplenium marinum*. From Miss Gage's list there would appear to be nearly 300 phanerogamous plants and ferns in the island.

Dr. Cleghorn stated that in August last he visited the Giant's Causeway and Isle of Rathlin in company with Dr. Merriman of Kensington and Mr. T. Merriman. They traversed a considerable portion of the island, observing many of the plants mentioned in the list, *Ulex nanus* being in profusion. *Sedum reflexum* occurs at Fair Head and in various localities along the Antrim cliffs. Whoever has experienced the strong currents or boisterous gales in these seas, will not hesitate to attribute the dissemination of species to their agency—along with the transport of innumerable migratory sea birds which whiten the cliff. The party received much kindness under the hospitable roof of the Rev. R. Gage.

Dr. Cleghorn exhibited the large ligneous fruit of *Hydnocarpus inebrians* (Vahl), which is used for poisoning fish in Malabar. Lamp oil is extracted from the seeds. He showed a drawing of *Erythropsis Roxburghiana* (Lindl.), an extremely handsome tree. The rich scarlet panicles of flowers burst forth after the monsoon, long before the foliage appears. Also the fruit of *Sterculia fætida* (Linn.), a common forest tree of stately size, widely diffused: the flowers yield an offensive odour, indicating to the traveller its immediate vicinity when riding through the jungle. The seeds are roasted and eaten like chestnuts. Dr. Cleghorn adverted to the difficulty of studying timber trees in the primæval forests, and stated it to be one of the most difficult departments of tropical botany.

Dr. Balfour read a letter which he had received from Professor Fries, dated Upsal, 1st November 1849. In this letter, Fries thanks the Society for the specimens of *Hieracia* which had been transmitted to him, and states that he had found them useful in compiling his recent work, 'Symbolæ ad Historiam Hieraciorum.' He promises to send some critical species in return.

Mr. Wyville T. C. Thomson read a letter from Mr. Westwood, Dollar, mentioning the discovery of *Potentilla tridentata* on Ben Wyvis several years ago. No specimens were sent, and some doubts were expressed as to the discovery.

Mr. Thomson also exhibited a specimen of *Salix retusa* which had been gathered by a friend of his on Ben Lawers.

Mr. McNab exhibited a specimen of the spathe and flowering spadix of *Euterpe montana* (mountain cabbage palm), and noticed the rapidity with which the branched spadix is developed. It would appear that the branches of the spadix are confined by the spathe until their resiliency bursts it, and the branches at once spread out at right angles from the common rachis. Although this palm has flowered frequently of late in the Palm House of the Botanic Garden, it has not produced perfect fruit as it used to do many years ago.

Dr. Balfour exhibited a specimen of wood hyacinth (*Agraphis nutans*), gathered by Mr. John Jeffrey, Edinburgh Botanic Garden, near Lochar, in Fife, in which all the bracts were converted into green leaves, many of them four to five inches long and one-eighth broad, giving

the plant a very peculiar aspect. This variety was originally introduced from Inverness-shire, and has been cultivated many years in the Garden at Lochar.

A letter was read from Mr. Hailstone, mentioning that he had gathered specimens of *Cynosurus echinatus* near Thorpe Arch, Yorkshire.

Mr. J. T. Syme exhibited a specimen of *Melilotus arvensis* picked between Inverkeithing and Limekilns. This plant has been observed in several spots near Edinburgh, more especially at St. David's and other parts of Fife.

Dr. Balfour exhibited a specimen of *Eriophorum alpinum* picked by him in Durness, Sutherlandshire, 21st August 1827, when accompanying the late Professor Graham on a botanical trip. Dr. Balfour stated that, at that time, he had just commenced the study of botany, and that the plant was put by him among specimens of *Scirpus cæspitosus*.

IPSWICH MUSEUM.

“On the Gigantic Birds of New Zealand, and on the Geographical Distribution of Animals :” the substance of a Lecture delivered at the Anniversary Meeting of the Ipswich Museum, by Professor Owen.

After some appropriate introductory remarks, Professor Owen entered upon the subject of his discourse by narrating the circumstances which first brought to his knowledge the fact of the existence, at some former period, if not at the present time, of gigantic birds, incapable of flight, in the islands of New Zealand. He exhibited a single fragment of bone, which had been submitted to him in 1839, which was affirmed to have been found in New Zealand, and he defined the steps in the series of comparisons which led to the conclusion that it must have formed part of a bird as large as the Ostrich, but of a heavier and less agile species. He next gave an account of the different species of wingless or struthious birds which were known to science at that time; he more especially described the Apteryx of New Zealand, and the Dodo of the Mauritius; and pointed out the remarkable character of their geographical position. The progressive steps in the restoration of the probably extinct wingless birds of New Zealand were then explained and illustrated by the plates of the works which Professor Owen had published on the subject, and by enlarged diagrams. The importance attached to the first fragment of bone stimulating the colonists to special researches, the remains of these extraordinary birds, which had escaped the notice of Banks and Solander, and successive naturalists, up to the year 1839, were soon obtained, and in unexpected abundance and perfection. The bones of the leg were first transmitted in October 1843, by the Rev. Mr. Williams, a church missionary, now Archdeacon of the Diocese of New Zealand. Casts and figures of some of the most remarkable of these bones were exhibited and explained. They indicated at least five distinct species, varying in height from three feet to eleven feet. The average stature of the Ostrich is six feet. The absence of air-cells in these bones, and their dense structure, confirmed the original

deduction as to the terrestrial character of the birds, and the relative shortness of the ankle-bone (metatarsus) as compared with that in the Ostrich, proved the original surmise as to the more sluggish character of the bird to have been correct.

Successive sets of bones of the great extinct birds were subsequently acquired, either by purchase or donation, by Professor Owen, who in 1846 published his third memoir on the subject, describing the structure of the back-bone (vertebræ) and the breast-bone (sternum) of the *Dinornis*. The latter he described as one of the most characteristic bones in the skeleton of a bird; it usually presents a part called the "keel," the depth of which is in the ratio of the size and power of the muscles used in flight, the keel being totally wanting in birds that are unable to fly. Thus the breast-bone resembles a shield in the Ostrich, Emeu, Cassowary, and Apteryx, but each of the existing wingless birds has the shield-shaped sternum of a peculiar pattern. The sternum of the *Dinornis* was equally devoid of a keel, and in its shape it most resembled the sternum of the Apteryx. From the size and strength of a bone of the neck (cervical vertebræ), also described and figured in the third memoir, the author had been led to certain inferences as to the kind of food on which these gigantic birds found subsistence in the small island to which they had been so singularly restricted; but still the head and beak were wanting, upon which any precise idea of the food of the species could be founded.

In 1847, the researches of Mr. Walter Mantell in New Zealand were rewarded by the discovery of the much-wished-for bones of the head and beak, and these specimens formed the subject of a memoir, published in 1848, in which they were described and figured, and referred to four distinct genera of birds. To two of these genera belong the largest bones of the wingless birds that have been discovered in New Zealand. They were called *Dinornis* and *Palapteryx* respectively. Magnified diagrams of the skull and beak of each were exhibited and explained by the Professor; who concluded by some general remarks on the geographical distribution of the known existing and extinct birds, the laws or conditions of which were illustrated by analogous facts in the distribution of the species of quadrupeds.

Had all the terrestrial animals, he observed, that now exist, diverged from one common centre within the limited period of a few thousand years, it might have been expected that the remoteness of their actual localities from such ideal centre would bear a certain ratio with their respective powers of locomotion. With regard to the class of Birds, one might have expected to find that those which were deprived of the power of flight, and were adapted to subsist on the vegetation of a warm or temperate latitude, would still be met with more or less associated together, and least distant from the original centre of dispersion, situated in such a latitude. But what is the fact? The species of no one order of birds is more widely dispersed over the earth than the wingless or struthious kind. Assuming that the original centre has been somewhere in the south-western mountain range of Asia, there is but one of the species of flightless birds whose habitat can be reconciled with the hypothesis. By the neck of land still

uniting Asia with Africa, the progeny of the primary pair created or liberated at the hypothetical centre might have travelled to the latter continent, and there have propagated and dispersed themselves southward to the Cape of Good Hope. It is remarkable, however, that the Ostrich should not have migrated eastward over the vast plains or steppes which extend along the warmer temperate zone of Asia, or have reached the southern tropical regions; it is in fact scarcely known in the Asiatic continent, being restricted to the Arabian Deserts, and being rare even in those parts which are most contiguous to what we may call its proper continent—Africa. If we next consider the locality of the Cassowary, we find great difficulty in conceiving how such a bird could have migrated to the islands of Java, the Moluccas, or New Guinea, from the continent of Asia. The Cassowary is not web-footed like the swimming birds; for wings it has only a few short and strong quills. How could it have overcome the obstacles which some hundreds of miles of ocean would present to its passage from the continent of Asia to those islands; and furthermore, how is it that no individuals have remained in the warm tropical southern border of Asia, where the vegetable sustenance of the Cassowary seems as abundantly developed as in the islands to which this wingless bird is now exclusively confined? If the difficulty already be felt to be great in regard to the insular position of the Cassowary, it is still greater when we come to apply the hypothesis of dispersion from a single centre to the Dodo of the island of Mauritius, or the Solitaire of the island of Rodriguez. How, again, could the Emeu have overcome the natural obstacles to the migration of a wingless terrestrial bird from Asia to Australia? and why should not the great continent of Asia have offered in its fertile plains a locality suited to its existence, if it ever at any period had existed on that continent? A bird of the nature of the Emeu was hardly less likely to have escaped the notice of naturalist travellers than the Ostrich itself; but save in the Arabian Deserts, the Ostrich has not been found in any part of Asia, and no other species of wingless bird has ever been met with on that continent: the evidence in regard to such large and conspicuous birds was conclusive as to that fact. In order that the Rhea, or three-toed Ostrich, should reach South America, by travelling along that element on which alone it is organized and adapted to make progress, it must, on the hypothesis of dispersion from a single Asiatic centre, have travelled northward into the inhospitable wilds of Siberia: it must have braved and overcome the severer regions of the arctic zone: it must have maintained its life with strength adequate to the extraordinary power of walking and running over more than a thousand miles of land or frozen ocean utterly devoid of the vegetables that now constitute its food, before it could gain the northern division of America, to the southern division of which it is at present, and seems ever to have been, confined. The migration in this case could not have been gradual, and accomplished by successive generations. No individual of the large vegetable-feeding wingless bird that now subsists in South America could have maintained its existence, much less hatched its eggs, in

arctic latitudes, where the food of the species is wholly absent. If we are still to apply the current hypothesis to this problem in Natural History, we must suppose that the pair or pairs of the Rhea that started from the highest temperate zone in Asia capable of sustaining their life, must have also been the same individuals which began to propagate their kind when they had reached the corresponding temperate latitude of America. But no individuals of the Rhea have remained in the prairies or in any part of North America—they are limited to the middle and southern division of the South American continent. And now, finally, consider the abode of the little Apteryx at the Antipodes, in the comparatively small insulated patch of dry land formed by New Zealand. Let us call to mind its very restricted means of migration—the wings reduced to the minutest rudiments, the feet webless like the common fowl's, its power of swimming as feeble! How could it ever have traversed six hundred miles of sea, that separate it from the nearest land intervening between New Zealand and Asia? How pass from the southern extremity of that continent to the nearest island of the Indian Archipelago, and so from member to member of that group to Australia—and yet leave no trace behind of such migration by the arrest of any descendants of the migratory generations in Asia itself, or in any island between Asia and New Zealand?

If these facts were inexplicable on the hypothesis of the dispersion of the species of the air-breathing animals from a singular Asiatic centre, we must next endeavour to collect analogous facts, and classify them, and so try to explain intelligibly, *i. e.* agreeably with the facts, the true law or cause of the actual geographical distribution of animals. The time allotted to the lecture obliged the Professor to limit his remarks on this subject to the quadrupeds of the class Mammalia.

The dry land of our planet might be divided, in relation to this inquiry, into the following parts:—1. Asia and Europe, which obviously formed one natural tract or continent; 2. Africa; 3. North America; 4. South America; 5. Australia; 6. Scattered islands, as New Zealand, separated by hundreds of miles of sea from any continent. The most characteristic aboriginal quadrupeds of the first division were the elephant, rhinoceros, ox, deer, tiger, bear, hyæna, beaver, hares and rabbits, certain kinds of ape and monkey. In Africa, the quadrupeds were for the most part similar as to genus, but different in species. The elephant differed in the structure of its teeth and feet from that of Asia. The rhinoceros of Africa had two horns, that of Asia one horn. The camel of Asia has two humps, that of Africa one hump. The lion represented in Africa the tiger of Bengal. The hyæna of Southern Africa was spotted, that of Asia was striped. There were also several quadrupeds of which no species now exists in Asia, and which are peculiar to Africa; *e. g.* the hippopotamus, the giraffe, the orycteropus, &c. Africa is also remarkable for its numerous species of large antelopes, of which but few exist in Asia, and none at all in America. In the northern division of the American continent, many of the mammalian genera

of the old world were represented, but by distinct species. The black bear of North America differed from the brown bear of Europe; the bison from the aurochs, or any other bovine animal of Europe, Asia, or Africa. The beaver of Canada was distinct from the beaver of Europe; but there were some genera of the smaller quadrupeds quite peculiar to North America.

When we come to compare the mammalia of South America, almost every aboriginal species belongs to a genus unknown in any other part of the world. The monkeys which abound in the tropical part of this continent differ from those of the old world by having an additional number of certain teeth, and, for the most part, a prehensile tail; they have also a different physiognomy—the nostrils are wider apart, giving greater breadth and flatness to the nose: this is the case without exception among the South American monkeys, whence they are called *Platyrrhines* in Systematic Natural History. All the monkeys of the Old World, equally, without exception, have the nostrils approximated, and they are called *Catarrhines*: none of them have the prehensile tail. This fifth member in the *Platyrrhine* group gives them additional power of grasping and climbing—makes them even more peculiarly arboreal; and a similar relation to a forest country may be traced through most of the peculiar forms of South American mammalia. The sloths are so expressly adapted for living in trees, that every other kind of life and mode of locomotion has been sacrificed, so to speak, to the perfection of their organization as climbers. Much compassion has been wasted upon their helpless condition when contemplated in their awkward attempt to move on level ground—the common theatre of the activities of mammalian quadrupeds. At the foot of these trees lived the races of armadillo and ant-eater, also peculiar to South America. Both were destined to feed on the countless swarms of termites that subsist on the decaying timbers, and the armadillos were particularly protected by their bony armour from the effects of falling boughs and trees.

In Australia the native quadrupeds were not merely distinct in species and genus from those in other parts of the world, but belonged to a peculiar division of the class Mammalia, characterized by a portable nest for the young, called the “marsupium.” Some of these “marsupial” animals were carnivorous, others herbivorous,—some terrestrial, others arboreal,—some were burrowers, others swimmers: among the latter was the curious *Ornithorhynchus*, with the tail of a beaver, the skin of a mole, the beak of a duck, and the spurs of a cock. These creatures performed in Australia all the parts which the other kinds of quadrupeds performed on the larger continents, but were of a different and lower grade of organization. New Zealand was remarkable for the total absence of any aboriginal species of terrestrial quadruped. Those that now abound in the island had been imported by the colonists from Europe, and there was no natural obstacle to their well-being and increase in New Zealand.

Finally, the Professor entered upon the question—How long has this geographical distribution of animals prevailed upon the earth? and showed that the results of the acquisition and determination of

the fossil remains of the animals buried in the newer tertiary strata, established the fact that in Europe and Asia, during the period antecedent to any natural evidence of the existence of man, the same peculiar forms of mammalia, which he had cited as now characteristic of that tract of dry land, were distributed abundantly over that great natural continent, from which England had not then become separated. That in South America, instead of elephants, rhinoceroses, oxen, deer, bears, hyænas, &c., there were found, in the freshwater deposits of the corresponding period, fossil remains of sloths, armadillos, ant-eaters, many of them of larger size than the existing kinds, and some, as the megatherium *e. g.*, gigantic. That in Australia the bone-caves and newer tertiary deposits had already revealed fossil remains of both existing and extinct "marsupial" animals, some also of gigantic bulk, and all allied or belonging to the present peculiar genera of that continent. But that no fossil relic of any genus or species of quadruped known in the rest of the world had been found in Australia. Lastly, in New Zealand, the strata contemporary with those from which the fossil quadrupeds above mentioned had been obtained, had not been found to contain the fossil remains of any species of land quadruped, but abounded in the remains of the wingless birds allied to the little Apteryx, now peculiar to New Zealand, but of larger dimensions, and some towering to the extraordinary height of eleven feet.

MISCELLANEOUS.

Notice of specimens of the Wheat Midge from Nova Scotia.

By J. W. DAWSON.

THIS destructive little creature has, within the last four or five years, extended its ravages to Nova Scotia. It made its appearance first in the western counties, and has gradually extended its limits eastward. It is now found in every part of the province, and has, in some districts, caused an almost total abandonment of wheat culture. The specimens accompanying this notice were reared from the larva state; and as I believe this has not often been attempted with success, I shall shortly state the means by which they were obtained.

When I first became acquainted with this insect, I procured specimens of the full-grown larvæ and placed them in a phial, with the view of observing their assumption of the perfect state in spring. None of them however appeared, and I subsequently learned that similar experiments had been tried without success; the belief among entomologists being, that the larva descends into the ground to complete its changes. I could not however ascertain that this belief had been confirmed by actual experiment or observation.

To satisfy myself on this point, (obviously of importance in reference to the means which may be devised for destroying these animals,) I obtained a fresh supply of the larvæ in that motionless and apparently torpid state in which they are found in the ripe wheat in autumn. In the month of November, a few dozens of these larvæ were

placed on the surface of moist soil in a flower-pot, in which a carnation was growing. In the course of two days they had, with the exception of a few which were crushed or otherwise injured, descended into the ground, leaving their delicate membranous cases on the surface. Their power of burrowing having been thus ascertained, they were allowed to remain undisturbed during winter, the spot where they had disappeared being covered with a glass shade. During winter the flower-pot was watered as the growth of the carnation required.

A similar experiment having been tried in another pot, the insects were sought for in the ground after their disappearance. Very few were found, and these had still the larva form. They were however most flexible, and showed some degree of activity. On being placed on the surface they endeavoured to burrow, by means of a worm-like motion, and in doing so they seemed to have the power of fixing the anterior part of the body pretty firmly to the soil. They were found to have penetrated to the depth of about an inch. It thus appeared that the stiffness and torpidity of the larvæ in the ripe grain are but temporary, and that when they fall from their place within the chaff scales, upon the moist ground, and cast their skins, they acquire the activity and strength necessary for penetrating into the soil, while still in the larva form.

The insects were not again seen until the last week of June, when they began to appear in the imago state, and as early as the 10th of July the whole had emerged. At that date there was no wheat in blossom in this vicinity, but the development of the insects had probably been hastened by the warmth and shelter of the house. The emergence of the midges appeared to take place in the evening, but was not actually observed. After they had taken wing, their pupa-cases remained projecting from the ground, and were white and membranous. When examined by the microscope, they showed the true chrysalis form, the wings and other external organs being distinctly marked on them.

The remainder of the larvæ procured in autumn having been kept dry in a paper box, have lost their orange colour, and appear to be quite dead, moisture being apparently absolutely necessary to their entering on the pupa stage.

The insects obtained in the above-described manner were of both sexes. The females agree in their characters with the figures and descriptions of the European *Cecidomyia Tritici**. The males, which I have not seen figured or described, are distinguished by their smaller size, differently-formed abdomen, and longer and more hairy antennæ.

I am not aware whether the mode of hybernation of the wheat midge or "weevil" is generally known to farmers in the United States. If not, it is well worthy of attention, since, by cutting the wheat early, and carefully collecting the larvæ contained in the chaff, and dust separated from the grain, a large proportion of the ensuing

* Curtis, Journ. of Agric. Soc. England.

year's brood may be destroyed. On the other hand, if the larvæ be allowed to be scattered over the fields or barn-yard, a plentiful supply of "weevils" for the next crop is secured. This method was proposed several years since by Prof. Henslow, but I have not been able to ascertain whether it has been used extensively in America.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 210.

On the Characters and Intimate Structure of the Odoriferous Glands of the Invertebrata. By Dr. LEIDY.

Nature has supplied most or all animals with some means of defence or protection, through which their destruction is rendered limited. The character of such means varies exceedingly: some are encased in hard armour; some are endowed with great muscular strength, some with great rapidity of movement; others trust to their minuteness, some to their colour; others feign death; many are furnished with formidable instruments, such as teeth, claws, aculei, &c.; others are supplied with organs which emit an odour so offensive that an aggressor is frequently compelled to leave what otherwise would have been its victim, &c. It is to the last-mentioned organs to which I at present wish to direct, for a few moments, the attention of the members; to the organs denominated odoriferous glands of animals. Bodies of this, or of a homologous character, are possessed by nearly all animals, but they are not in all used as a means of defence. They give origin to the odour which appears to be more or less peculiar to each species of animal, and which probably is in some way connected with the sexual instinct. The scent-bag of the *Moschus moschiferus* is the homologue of the glandulæ odoriferæ Tysoni of the human prepuce; the tegumentary mucous glands of mollusca, of annelides, of fishes, the tegumentary glands of reptiles, the perspiratory and sebaceous glands of birds, and of mammals, the odoriferous glands of insects, the anal sacs of carnivora, &c., are all probably of a homologous character.

Although varying in the degree of their complexity in different animals, and in the character of their secretion, yet the essential structure is the same throughout. Consisting of tubes or follicles of basement membrane, their complexity depends upon their greater or lesser length, their being simple or compound, straight or more or less convoluted, and isolated or aggregated, in connection with the mode of supplying to them their nutritive fluid.

On the interior these cavities or tubes are covered with a single layer of nucleolo-nucleated organic cells, the true elaborators or manufacturers of the secreted matters of the glandular bodies.

The secreted matter varies exceedingly in its properties in different animals; in odour being found from that of the perspiratory fluid of man, through a great variety of shades, to that most powerful and odious of all odours, the secretion of the anal glands of the *Mephitis Americana*; in consistence from a semi-fluid state to the gaseous fluid of the *Brachinus crepitans*, &c. It is this which constitutes

the material contained within the organic cells intermediate to the cell-wall and the nucleus.

The cell-wall and nucleus are the agents in connection with the organic force which produce or elaborate the contained matter. And, indeed, this is the ultimate fact of all organization; for all the innumerable objects of living nature, with such variety of form, composition, and colour, from the simplest to the most complex; from the vibronic filament to the noble oak, from the Bodo, or Monas, up to man, are the result of a force in connection with an amorphous vesicle, the organic cell-wall, with the contained nucleus. Wonderful, indeed, is it that the human mind at length has been enabled to penetrate so deeply into the mysteries of nature as to discover the starting-point of life, the stile at which an invisible intangible cause operates in the production of all those beings we call organized. From this digression I return once more to the consideration of the odoriferous glands. In many of the higher animals, the structure of these has been carefully investigated, but not to the same extent in the lower animals.

In Hemipterous insects these bodies are situated within the posterior part of the metathorax or anterior part of the abdomen, and consist of one or two, more or less long and convoluted cæca, which open exteriorly usually between the coxæ of the middle and posterior legs.

In the carnivorous Coleoptera they are situated in the posterior part of the abdomen, on each side of the rectum, and usually open exteriorly upon the membrane, connecting the inferior and superior plate of the last abdominal segment on each side of the anal aperture. They generally consist of a number of follicles, which converge to one or more ducts, which join the neck of a reservoir for containing the secreted fluid. A number of these are figured by Dufour in the 'Annales des Sciences Naturelles' for 1826.

In the genus of Myriapoda, *Julus*, the odoriferous glands are placed upon each side of the body, every segment which has a double pair of legs possessing a pair of the glands, commencing anteriorly with the sixth segment, excepting the head, and terminating posteriorly with the penultimate segment. As the number of segments of the animal varies with its age, so will also the number of the odoriferous glands. The adult *Julus marginatus* has usually fifty pairs; the *Julus maximus*, from New Grenada, S. A., has fifty-eight pairs, &c.

The orifices of these glands opening exteriorly, correspond to a row of minute black dots on each side of the body, situated about midway between the superior and inferior median line.

The glands of *Julus* consist of a globular body or sac, with an elongated conical neck, and resemble in form a Florence flask with the mouth drawn to a point. In *Julus marginatus* they measure $1\frac{1}{4}$ line long, the body being $\frac{3}{4}$ of a line in diameter. In structure they consist of an amorphous transparent basement membrane covered upon the interior surface with a single layer of secreting cells. The cells are polygonal, from mutual pressure, measure $\frac{1}{16}$ to $\frac{1}{12}$ inch in dia-

meter, and are filled with a yellowish fluid, and a fine purplish granular matter, which in mass gives them a dark purple colour, and which, in the aggregate of the cells, gives the glands a very deep purple or almost black colour. When the cells are compressed, or the contents pressed out, the granules exhibit lively molecular movement.

In the centre of the mass of granular matter of the cell, and only seen upon compressing the latter, is a round, translucent nucleus, measuring the 1-5000th inch in diameter, and containing a minute refractive nucleolus.

The secreting cells vary in colour in different insects, and in the aggregate give the colour to the glandular bodies. The reservoir also is lined with cells. In *Upis Pennsylvanica* they are brownish, or nearly colourless, measure the 1-750th inch in diameter, contain some finely granular brownish matter, and a large round or oval translucent, faintly granular nucleus, measuring 1-1250th inch, with a large, round or oval nucleolus 1-2727th inch in diameter.

The secretion of the glands of *Julus marginatus*, contained within the interior of the body, is deep yellow in colour, and contains a few of the purplish granules of the cells. It resembles oil in consistence, but is soluble in water and alcohol. It is neither acid nor alkaline; evaporates at a temperature of 250° F., without residue; is acrid to the tongue, Schneiderian membrane, and conjunctiva; smells like hydriodic acid, and stains the cuticle brown. The last two properties led me to suspect the existence of iodine, but the usual reagents presented none. It probably belongs to a class of peculiar organic compounds, found in the odoriferous principles of animals, not yet investigated.

Exteriorly the reservoirs of the odoriferous glands of insects are furnished with transverse muscular bands of a brownish colour, about 1-1578th inch in breadth, and separated by wide intervals.

In *Julus* the body of the glands possesses no distinct muscular bands, but the neck is provided with them.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 234.

JOURNEY TO EXPLORE THE NATURAL HISTORY OF SOUTH AMERICA.

To the Editors of the Annals of Natural History.

GENTLEMEN,

24 Bloomsbury Street, Jan. 19, 1850.

In the January Number of your valuable Magazine for 1849, you were good enough to insert extracts from a letter I had received from Messrs. Wallace and Bates, two gentlemen who are investigating the *Natural History* of the Amazon River and its tributaries in South America, and who consign their collections to me for sale. I now send you extracts from a letter just received from Mr. Wallace, dated Sautarem, Sept. 12, 1849, which, if you think sufficiently interesting, you may perhaps feel inclined to insert:—

“I have got thus far up the river, and take the opportunity of sending you a few lines. To come here, though such a short distance, took me a month. I am now waiting here to get to Montalegre, but the difficulties of getting men even for a few days are very great. Here

the country is very sandy and dry, with a scrubby, shrubby vegetation; there are however some patches of forest, and in these, Lepidoptera are rather abundant; there are several lovely *Erycinidæ* new to me, and many common insects, such as *Heliconia Melpomene* and *Agraulis Dido*, abundant, which we hardly ever saw at Parà: Coleoptera I am sorry to find as scarce as ever. I hope however to do better at Montalegre, as the hills there are near a thousand feet high, and must I should think produce some. I wish to know what is thought of Cuyaba in the province of Matto Grosso as a locality; it is at the head of the Tapajoz and Paraguay River; there is a communication from here, salt being taken up. I could also from Rio Nigro get up the Madeira to Matto Grosso city, or up some branches into Bolivia. Is Bolivia at all known? I see in the Museum Catalogue only five or six *Erycinidæ* from it, from Mr. Brydges' collections. I see there is a branch of the Andes in it the highest in America, and its capital cities appear higher ground than even Bogota or Quito. Either of the localities can be I think quite as easily reached as the Andes up the Amazon; at all events I should like to know if the ground is open and likely to be good, for some future time, if not just at present. I shall I think get up the Rio Nigro towards the sources of the Orinooko, but I am rather fearful that all N. Brazil is rather poor in Coleoptera.

"September 14th.—I believe I shall now start for Montalegre tomorrow, having a canoe lent me; I have however found so many new species of Lepidoptera, that I shall probably stay here a month on my return before going to Rio Nigro, unless indeed I find Montalegre so very good as to induce me to spend till December there. I do not think that you need send me anything till I write again. Pray write whenever you can, and give me all the information you may be able to obtain, both as to what things are wanted in any class or order and as to localities.

"The Tapajoz here is clear water with a sandy beach, and the bathing is luxurious; we bathe here in the middle of the day, when dripping with perspiration, and you can have no idea of the excessive luxury of it; the water is so warm that then is the healthiest time. Oranges are about fourpence a bushel here, and are far the best fruit; large pineapples twopence to fourpence, but we seldom eat them. The more I see of the country, *the more I want to*, and I can see *no end* of, the species of butterflies when the whole country is well explored. Remember me to all friends."

I am, Gentlemen, your obedient Servant,

SAMUEL STEVENS.

ON THE GENUS GREGORINA.

M. L. Dufour has applied the name of *Gregorina* to some microscopic organisms which live as parasites in the intestinal canal of some insects, especially of larvæ. M. Koelliker found that these creatures were composed of a single cell, and are as simple as some of the lower genera of plants. Some objections urged against this monocellular nature, by Henle and Fantzius, have induced M. Koel-

liker to submit the *Gregorinæ* to fresh observation. The following are the conclusions at which he arrives in his last memoir:—

1. The *Gregorinæ* are animals.

2. The simple *Gregorinæ* are decidedly composed of a single cell. Their membrane corresponds to the cellular membrane; their contents are those of a cell; the vesicle which it contains represents the nucleus; the granulations (sometimes there is only one) of the latter are simple or disaggregated nucleoli. These simple *Gregorinæ* are only met with in Annelides.

3. The *Gregorinæ* with constricted body most probably correspond also to a simple cell of a peculiar form. They are met with in insects and crustacea.

4. There is no reason for not considering the *Gregorinæ* as animals which have attained their most perfect state.

5. The cases of pseudo-navicellæ with granular contents and with vesicles probably proceed from a transformation of the *Gregorinæ*.

6. The presence of two nuclei or of two cells in the interior of certain *Gregorinæ* indicates either the commencement of their reproduction or their transformation into pseudo-navicellæ.—*Zeitschrift für Wissenschaftliche Zoologie*, i. p. 1.

NYCTOTHERUS, a new genus of POLYGASTRICA allied to PLESCONIA.

By Dr. LEIDY.

Body ovate, dilated posteriorly, compressed anteriorly, granulated, longitudinally lined, with an apparent operculum covering its anterior half, and having a semicircle of cilia just within its margin inferiorly and posteriorly. Centre of the operculated portion furnished with a large trapezoidal finely granular areola. Posterior part of the body with a short fissure passing inwards and downwards.

Nyctotherus velox. Body white, ovate, conoidal, anterior margin rounded, obtuse; posteriorly acute. Posterior margin of the apparent operculum passing in a curved line upwards upon the middle of the body to within a short distance of the back, and furnished inferiorly with a point projecting backwards; with a line passing down from the back about the middle of the operculum to the trapezoidal areola, giving the part of the body anterior to this the appearance of a head. Trapezoidal areola with curved sides, finely granular. Posterior fissure communicating with the exterior, just above the acute termination of the body, and passing inwards and downwards, resembles an anal aperture. Areolæ of the interior sarcous mass generally minute, one large and round pretty constantly to be observed at the inner termination of the posterior fissure.

Length from 1-254th to 1-180th in.; breadth from 1-320th to 1-254th in.

Hab. Commencement of the large intestine of *Julus marginatus*, often found in considerable numbers.

Remarks. This genus is closely allied to *Plesconia*, but possesses no appendages excepting the semicircle of cilia, just within the edge of the apparent operculum.

The animal swims in water with great ease and grace. After being

in this fluid some time, the external investment bursts, and allows the protrusion of globular masses of sarcoous matter, as in *Leucophrys*, but not to such a great extent.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 233.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1849.

Chiswick.—December 1. Very fine. 2. Heavy rain throughout. 3. Rain. 4. Hazy clouds: fine: frosty. 5. Rain with fog: overcast at night: slight frost. 6. Clear sky and low ground-fog: exceedingly fine. 7. Overcast. 8. Rain: cloudless, and very fine. 9. Frosty and foggy: fine: dense fog. 10. Foggy: uniform haze: overcast. 11. Overcast. 12. Foggy: cloudy and cold. 13. Slight drizzle: hazy. 14. Rain: drizzly. 15. Rain: clear at night. 16. Cloudy: very fine: drizzly. 17. Boisterous: fine: clear. 18. Densely overcast: rain. 19. Cloudy: fine: clear. 20. Clear and fine. 21. Slight snow-showers. 22. Frosty: densely clouded. 23. Clear and frosty: cloudless: clear and frosty. 24. Hazy: slight snow: cloudy at night. 25. Clear and fine. 26. Drizzly: densely overcast. 27. Clear. 28. Drifting snow: clear and frosty throughout: severe frost at night. 29. Cloudy: clear. 30. Clear. 31. Cloudy: fine: overcast.

Mean temperature of the month	37°·17
Mean temperature of Dec. 1848	41 °75
Mean temperature of Dec. for the last twenty-three years	39 °85
Average amount of rain in December	1·58 inch.

Boston.—Dec. 1. Fine. 2. Rain: rain A.M. and P.M. 3. Rain: rain A.M. 4. Fine. 5. Cloudy: rain A.M. and P.M. 6. Fine. 7. Cloudy. 8. Rain: rain A.M. 9. Fine. 10. Cloudy. 11. Rain: rain A.M. and P.M. 12. Fine. 13, 14. Cloudy. 15. Cloudy: rain A.M. and P.M. 16. Fine. 17. Cloudy: rain early A.M. 18. Cloudy: rain A.M. and P.M. 19. Fine: rain A.M. and stormy. 20. Fine. 21. Cloudy: rain A.M. 22. Cloudy. 23. Fine. 24. Cloudy: rain A.M. 25. Cloudy. 26. Fine. 27, 28. Fine: stormy. 29. Fine: snow A.M. 30. Fine. 31. Cloudy.

Applegarth Manse, Dumfries-shire.—Dec. 1. Frost A.M.: fog: wet P.M. 2. Storm of wind and rain. 3. Blowing hard: wet: calm P.M. 4. Fine clear frosty day. 5. Snow A.M.: wet P.M. 6. Rain and wind. 7. High wind: rain P.M. 8. Rain, but not heavy. 9. Fog and light rain. 10. Fog all day. 11. Fair and frosty. 12. Clear and cold. 13. Dull and cold: sleet P.M. 14. Fine A.M.: cloudy and stormy P.M. 15. Foggy, with showers. 16. Fine A.M.: dull and damp P.M. 17. Fine, with slight showers. 18. Wet all day. 19, 20. Slight frost: fine. 21. Slight frost: fine: cloudy. 22. Slight frost: clear and fine. 23. Hard frost: cloudy P.M. 24. Change: soft: slight shower. 25. Frost again: mild P.M. 26. Slight frost: shower P.M. 27. Frost: clear: high wind P.M. 28, 29. Very hard frost: sprinkling of snow. 30. Frost: clear and fine. 31. Frost very hard: thermometer 18°.

Mean temperature of the month	37°·1
Mean temperature of Dec. 1848	39 °8
Mean temperature of Dec. for the last twenty-five years ...	38 °1
Mean rain in December	1·40 inch.
Ditto average for twenty years in December	2·94 inches.

Sandwick Manse, Orkney.—Dec. 1. Fine: cloudy. 2, 3. Showers. 4. Snow-showers. 5. Showers. 6. Cloudy: clear. 7. Cloudy: drizzle. 8. Showers: drizzle. 9. Cloudy: showers: rain. 10. Drizzle: clear: aurora. 11, 12. Cloudy: clear: aurora. 13. Cloudy. 14. Rain: cloudy. 15. Cloudy: showers. 16. Rain: showers: clear. 17. Cloudy: showers. 18. Showers: damp: showers. 19. Bright: showers: sleet. 20. Fine: frost: fine. 21. Fine: frost: aurora. 22. Clear: frost: hazy. 23. Rain: cloudy. 24. Fine: damp. 25, 26. Showers. 27. Hail-showers. 28. Snow-drift: thunder: snow-drift. 29. Cloudy: clear. 30. Showers: cloudy. 31. Clear: cloudy.

Days of Month.	Barometer.				Thermometer.				Wind.				Rain.			
	Chiswick.		Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Dumfries-shire.		Orkney, Sandwick.		Boston.		Dumfries-shire.	
	Max.	Min.	9 a.m.	9 p.m.	9 a.m.	8 p.m.	Max.	Min.	8 a.m.	Max.	Min.	8 a.m.	Max.	Min.	8 a.m.	8 p.m.
1849.																
Dec.																
1.	30.116	29.934	29.76	29.82	29.82	29.75	48	29	32	41 $\frac{1}{2}$	27	39	44 $\frac{1}{2}$	12	.....	.....
2.	29.821	29.419	29.40	29.52	29.40	29.70	50	40	44	46	41	45	44	.....	.....	.....
3.	29.521	29.415	29.26	29.54	29.30	29.62	40	31	39.5	40	38	41	37 $\frac{1}{2}$	.....	.....	.....
4.	29.542	29.520	29.26	29.52	29.30	29.86	39	19	30	35	27	35	38	.....	.....	.....
5.	29.379	29.275	29.18	29.22	29.08	29.47	49	29	30.5	39	29	41	40	.....	.....	.....
6.	29.722	29.640	29.33	29.20	29.50	29.38	52	34	37.5	43	36	44 $\frac{1}{2}$	45	.....	.....	.....
7.	29.623	29.372	29.37	29.49	29.35	29.77	49	41	40	45	38	45	42 $\frac{1}{2}$	.....	.....	.....
8.	29.622	29.392	29.10	29.81	29.45	29.75	49	25	41	43	39 $\frac{1}{2}$	41	43	.....	.....	.....
9.	30.018	29.816	29.59	29.69	29.89	29.96	45	26	34	43	42	42	45	.....	.....	.....
10.	30.129	30.155	29.85	29.50	30.10	30.17	39	35	34.5	42 $\frac{1}{2}$	39	45	39	.....	.....	.....
11.	30.030	29.879	29.74	30.12	30.11	30.36	41	34	35.5	41	33 $\frac{1}{2}$	39	39	.....	.....	.....
12.	29.851	29.843	29.55	29.70	29.50	29.93	56	30	35	39	34	40	39	.....	.....	.....
13.	29.865	29.808	29.50	29.50	29.38	29.55	47	30	32	39	33	40	42	.....	.....	.....
14.	29.951	29.773	29.45	29.60	29.29	29.38	55	48	41	46	30	42	43 $\frac{1}{2}$	.....	.....	.....
15.	29.911	29.661	29.40	29.50	29.30	29.38	58	46	50	49 $\frac{1}{2}$	44	45	43 $\frac{1}{2}$	.....	.....	.....
16.	29.859	29.525	29.14	29.28	29.50	29.41	53	40	43.5	49	42 $\frac{1}{2}$	45	45	.....	.....	.....
17.	29.766	29.426	29.25	29.30	29.40	29.55	52	42	44.5	49	42	44	44	.....	.....	.....
18.	30.276	29.878	29.50	29.90	30.10	30.15	45	32	42	47	36 $\frac{1}{2}$	41 $\frac{1}{2}$	38	.....	.....	.....
19.	30.312	30.233	29.92	30.25	30.36	30.38	41	30	53	48	32 $\frac{1}{2}$	38 $\frac{1}{2}$	39	.....	.....	.....
20.	30.491	30.394	30.16	30.50	30.59	30.62	35	29	34.5	47	29	37 $\frac{1}{2}$	34	.....	.....	.....
21.	30.530	30.519	30.30	30.60	30.66	30.73	37	28	32	35	31	33 $\frac{1}{2}$	36	.....	.....	.....
22.	30.572	30.516	30.33	30.62	30.46	30.50	35	22	33	33	28	45 $\frac{1}{2}$	45 $\frac{1}{2}$	.....	.....	.....
23.	30.404	30.372	30.07	30.40	30.53	30.61	36	24	34	42	32	41 $\frac{1}{2}$	43	.....	.....	.....
24.	30.530	30.326	30.22	30.50	30.30	30.43	38	28	33	41	29	46 $\frac{1}{2}$	44	.....	.....	.....
25.	30.148	29.798	29.80	30.02	29.54	29.84	42	34	37	47	37	45 $\frac{1}{2}$	41	.....	.....	.....
26.	29.493	29.434	29.16	29.40	29.42	29.43	41	27	35	45	32 $\frac{1}{2}$	32	24	.....	.....	.....
27.	29.552	29.340	29.08	29.40	29.48	29.41	47	16	33	33	21	24	32	.....	.....	.....
28.	29.641	29.548	29.22	29.54	29.69	29.76	36	26	31	39 $\frac{1}{2}$	22 $\frac{1}{2}$	38	37	.....	.....	.....
29.	30.219	29.952	29.80	30.05	30.20	30.18	38	28	33	38	29	37	42	.....	.....	.....
30.	30.322	30.302	30.03	30.24	30.21	30.23	38	17	31	30	18	45	45	.....	.....	.....
31.														.....	.....	.....
Mean.	29.978	29.824	29.59	29.800	29.806	29.900	43.42	30.93	36.2	42.1	33.4	40.90	40.69	1.28	3.17	4.22

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[SECOND SERIES.]

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XVI.—*On the recent Foraminifera.*
By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Norfolk Crescent, Bath, Dec. 1, 1849.

THERE appeared in the 'Annals' for May 1849, a paper of mine on the recent Foraminifera, containing some new facts and hypotheses on the anatomical structure of these polypi; a further examination during the summer months of this year has enabled me to confirm the facts I have already made known, to add much new matter, and to afford such rectifications of the hypothetical inductions as will stamp them with their proper value. I persist in my view, that all the calcareous organisms styled Foraminifera are fixtures for life, as is the case with every other polyparium of the calcareous division. I considered the specimens alluded to in my first paper decidedly recent, but the possession of others which were undoubtedly alive an hour before I received them, has convinced me of my mistake. The first specimens of *Dentalina linearis* and *Marginulina legumen* exhibited in the same shell one half hyaline, and the other with the animal remains, from which I concluded that the polypi inhabited only the two or three anterior cells, and the posterior ones were rendered hyaline by the withdrawal of their contents, either by absorption or desiccation; but it is more probable that the entire shells so often met with, having all their chambers perfectly hyaline, have been cleared out, at least in those species that have decided visible apertures, by very minute parasites, and that where the chambers are partially emptied the enemy has died before its work was accomplished, in consequence of the orifice being closed up by agglutinated fine grains of sand. I confidently rely on this explanation, as in long and careful examinations of the *Miliolidae*, I have found in them so many variously

formed parasites as to baffle, as yet, any positive determinations of the real animal inhabitant. It is necessary at once to describe the animal of *Dentalina linearis*, an inhabitant of the coral-line zone of the Devon coast, six miles from shore, in fifteen fathoms water, as it appeared in a beautiful recent adult specimen of many chambers, that it may be referred to in illustration of the additional observations I propose to make. I believe they will be found more comprehensive than any that have hitherto appeared on this very distinct section of the calcareous polypi. I consider this animal and that of the *Marginulina legumen* as the types of a great majority of the Foraminifera.

Genus *Dentalina*, D'Orbigny.

Dentalina linearis, Mont.

Animal elongated, yellowish or pale red-brown; it has a continuous subcylindrical membranous tube, coasting one of the sides of the polyparium or shell from the posterior to the anterior chamber. The lobes or parenchymatous matter forming the mass of the body of the animal are deposited in the palest brown membranes, and fully fill each and every division of the shell, being moulded on their forms; these segments are united to and open into the common canal, which appears to serve for defæcation, the admission of aliment, as an oviduct, and to convey moisture to the animal: the orifice thereof is in the adult shell terminated by eight slender equidistant pale red pointed minute tentacula.

In the genial season, July and August, each lobe on its flat surface is marked with a circle of deeper red than the other part, and which I may safely term a gemmiferous pullulation, as therefrom a line of minor gemmæ is seen proceeding from each bud to the margin of the common canal to discharge therein these undoubted germs of reproduction. Thus far, as regards the animal, no doubt can exist; but with respect to respiration, the circulation, the mode of growth of the animal and polyparium, these points must be received with caution, as they have not the test of certainty, though I believe they are substantially correct. I now state what I have perceived of the increase of the animal from segment to segment, and the corresponding formation of the same parts of the polyparium. In the examination of numerous specimens of this species and of *Marginulina legumen*, in which the last chamber was incomplete and not domed over, I have seen at the neck of the antepenultimate chamber a membrane encircling and lining the unfinished wall, and a mass of parenchyma adjacent, and apparently growing *pari passu* with the common membranous tube, which is always kept free and open, and thus the lobe, tube and chambers are gradually formed

by the pullulation of the parenchyme and exudation of calcareous matter from the enveloping membrane until the lobe is complete and receives the final stigma of eight new tentacula, the old ones being merged in or become the germs of the new production, and so on, until nature has finally completed her work. We thus see that this animal, when the first germ is cast, increases by pullulation, and at the same time performs the function of reproduction by committing its gemmæ to fix themselves in their natural habitats. From these circumstances it is probable that the calcareous organisms are solitary, distributed without order, and fixed to rocks, corals, and other hard submarine substances by the pointed stylet which is attached to the posterior terminus of many of the species; and in fresh specimens of this genus and *Marginulina legumen*, the fracture of the attaching stylet is very visible by a lens of common power; but from the tenuity and fragility of the penultimate appendages, these organisms almost always come to us detached, as the substances on which they are naturally fixed are probably rocks and coral reefs; we therefore can scarcely hope to see them *in situ*; and if they ever come into the dredge on fragments, they have from their small volume been passed over without observation, and again cast into the deep. I still however hope to see them in a state of nature: I have directed my dredger to bring in all masses from the coralline zone.

To return to the animal, a curious question arises: Is it a compound being, though a solitary organism? Does the formation of gemmæ on all the lobes indicate that each is a distinct being, which, instead of opening exteriorly as in many of the other sections of the compound polypi, receives sustentation from the common canal? can this continuous tube be merely to serve as an oviduct? is it not also to supply each lobe with water, food, and for depuration? If these questions are answered in the affirmative, each segment may be so far a distinct being, as a common connection between the whole mass admits of; on the other hand, does the isochronal development of gemmæ in all, the almost isolated lobes, evidence that the animal is a simple one? If this creature had the segments inclosed in a simple tube, as in the Annelidæ, I should answer, it is not a compound animal; and perhaps even in the first case, those better qualified to judge than myself, will decide it is a simple being, and that the contemporaneous appearance of gemmæ merely shows that each lobe is under a similar stimulus.

As to the movement of the fluids, I cannot believe that the common canal serves for four distinct functions—for food, the dejections, regeneration, and aëration, without an inconvenient interference of one organ with another; I am therefore in-

clined to think there are longitudinal vessels attached to the walls of the common canal to supply some of these functions, particularly that to administer, in conjunction with the capillary filaments, the oxygen. I do not believe there is a circulation beyond that of flotation, arising from nervous contraction—I say nervous, because I shall presently enunciate the reasons for using this term. The respiration is effected by the very fine capillary filaments which issue from the foramina of such of these animals that have them, and which have been named “*pseudopodia*,” or “*pedes spurii* ;” the filaments are only protruded from the last-formed chambers, which, until new ones are constructed, constitute the limits of the respiratory apparatus, the preceding ones being closed by the exudation of calcareous matter from the enveloping membrane of each lobe, and though the punctures of former foramina are always seen, they are imperforate. The sustentation of these animals is undoubtedly the minute animalculæ received through the orifice into the common canal—the eight tentacula prove this—and are there digested, and the nutritive fluids enter probably by absorption into each mass of parenchyme, the rejectamenta being discharged by the aperture.

On the question of the nervous and muscular influences, which Lamarek only admits, as independent of sensation and interior sentiment, in his apathetic animals, amongst which are the Polypi, I must be allowed to make a few observations, to explain my reasons for not concurring in the views of that great naturalist. Lamarek contends that sensation, or interior sentiment, does not exist in the lower animals, and that in them all movements arise from irritabilities excited by external impressions: I demur to this doctrine, and firmly believe that no created being can exist and exhibit evidences of vitality, by motion, without having implanted in it a certain degree of sensation or interior sentiment, by the influence of which the nervous and muscular powers are put in action. I grant that external causes may produce motions and contractions, not I think by exciting an irritability independent of sensation, as Lamarek terms it, but by the agents and after the manner I have just stated.

It will be admitted that the sensations in the lower animals, which are the origin of the nervous and muscular influences, are of the most subdued qualities; and though their points of departure, and the muscular supports dependent on them, may not be discernible by the most powerful instruments, still I believe that they exist, and produce those movements which are observed in the monad as well as in man. In the superior and larger animals, we can perceive the causes of these influences and admit their existence, because they are apparent; and why not in the smallest, though they escape our vision? In the nearest fixed

stars we can observe their proper motions, but in those which are plunged in the deeper regions of the sphere, these motions, though we may presume that they undoubtedly exist, are inappreciable. Why may we not apply a similar reasoning to the doctrine of the sensations or interior sentiment, and the resulting nervous and muscular influences, being implanted in the lowest as well as the highly organized animals, according to their several structures, and not consign vast classes to exist without sensation? It appears to me that the lines of separation between apathy, sensation, interior sentiment, and intelligence, as laid down by Lamarek, are erroneous and arbitrary. I believe that apathy in its strict sense, as applied to animals, does not exist; and I repeat, that the most inferior created animal being is not without that portion of sensation or interior sentiment, and its concomitant nervous and muscular influence, that produces the motions which are the tests of vitality. I may state that Lamarek does not admit the distinction of intelligence and instinct; he very justly considers the different degrees of what is called instinct, in animals, as only subdued intelligences consequent on their imperfect organs, when compared with the highest standard—man.

There is a great gulf between the intelligence of the brute creation and that of man; the impassable line is, that the one does not fear death, and has no idea of the future, because the beneficent Creator has not given it sufficient intelligence to reason on matters which will never be granted; but man fears death and ardently desires immortality, because his Maker has conferred on him the knowledge of life and death, and it may therefore reasonably be inferred, that we shall not be tantalized with a prospective view and hope of these things, if they were not to be accomplished.

To return to the *Foraminifera*: I am inclined to think that the major part of these organisms, whether straight, arcuated, discoid, alternate, enveloping, rolled *en peloton*, or whatever configuration they may take, will conform in all the essential generalities with the structure of the animal—I mean of those parts of it which I have clearly determined in the *Dentalina linearis* and *Marginulina legumen*, and which I consider may fairly be constituted the type of that section of the calcareous Polypi termed *Foraminifera*: these organisms, from their distinct and separate growth, show an advance in organization that justly places them at the head of the calcareous Polypi, and I think it will be long before this assigned position in the progressive order of creation will be disturbed. That specialty-differences of a more or less decided character exist in the component parts of this group cannot be doubted; such variations are seen in every

division of nature. In this class the greatest deviations are the polyparia of certain of the *Nodosariæ*, improperly called *Lagenæ*, as the *L. laevis* and its variety *L. amphora*, and the *L. striata* of authors and its numerous varieties, which undoubtedly have their chambers piled on each other, and form polypiferous stems varying in the number of the strangulations or separation of one globe from another; these constrictions are often so intense, as to afford the smallest possible, often doubtful perforations; they taper from bulb to bulb, and perhaps may only be hollow on the principle of the wheat straw, to afford increased elasticity to the stems to withstand the agitation of the waters in their natural habitats of fixity. When a stem is broken into fragments, as I have seen in the *Nodosaria laevis*, the *Lagena laevis* of authors, by the mere contraction of the drying of a solution of gum arabic to fix it on a card, in consequence of the extreme brittleness of the necks of the flask-shaped globules, the terminus, or what conchologists term the aperture, will always be found under the microscope to be formed, in *fresh* specimens, of five or six rough-edged radiations, of a very different character from the symmetrical ones of those polypi that have eight tentacula, and the counterparts of these irregular radiations in shape and number will be seen at the basal part of the same object; a very strong argument that these fragments have parted from succeeding bulbs at the smallest part of the strangulation, or in other words at the aperture, leaving the base of the bulb from which it has been separated imperforate, and showing that the cylinder of strangulation is only hollow up to that point in which the principle of flexibility is involved. Conchologists have always considered the long tapering tubes, often as long or longer than the bulb itself, to be the aperture of an inclosed animal: if they are right, it must become enveloped and die, having first deposited the germ of the succeeding nodule. This unusual and extended form of the neck and aperture only exists, I believe, in two species of the entire class of Foraminifera, the *Nodosaria laevis* and *N. striata*; every other form rarely extends its neck or aperture much beyond the bulb. These two very singular exceptions, combined with the extraordinary length of the strangulations, almost amount to a demonstration, that the *Nodosaria striata*, the only organism admitting of the slightest doubt, falls into the same category as the *N. laevis*, of which I have seen a stem of four united strangulations or chambers, and others of two and three. I therefore think it not improbable that the organisms, *Nodosaria laevis* and *N. striata*, are the frames of polyparia forming stems of nodules, which, when fresh from the coral zone, are always more or less incrustated, like many of the corallines, with pulpy cretaceous matter that serves as a nidus for the mi-

nute polypiferous constructors, which may be either compound or single animals. Cabinet specimens are almost always polished by attrition.

This statement is, I believe, the true solution of the conditions of the only two *Foraminifera* about which doubts can exist as to the animal; all the rest, without exception, follow the type of the animals I have described above as to generalities. I may add, that I have examined with the highest powers many of the *Nodosaria striata*, and have not detected a membranous animal lining, which better observers say they have seen. When there is a minute perforation at the side of the neck of the bulb, occasioned by a boring animal, in such, the chambers sometimes contain the remains of parasites and fine mud and sand that cause discoloration of the globules, which authors may have mistaken for parenchymatous matter. It is also possible that very minute parasites may enter at the strangulated necks when the stem is broken up, and locate themselves within, in like manner as in the *Miliolidae*, which, I have stated above, are constantly inhabited by parasites of various species. Whatever doubt may exist as to the animals of *Nodosaria lævis* and *N. striata*, I think there can be none of the *N. striata* having its unilocular globules piled one on the other. In this opinion I am strongly supported by an article in the February Number of the 'Annals' for 1849 by Mr. M'Coy, who thus observes on his *Nodosaria fusulinaformis* :—

"Shell of two or more inflated, pyriform, easily separable lodges, the first one having a small mucronate point at its posterior end, and contracted to a very slender, short neck at the anterior end which joins the pyriform second cell, which is also contracted to a similar minute neck in front; surface smooth."

Mr. M'Coy also observes, "that the lodges or cells are almost always found separated (from the minuteness of the connecting neck)." Mr. M'Coy also says, "I have however *heard* of several of them being found united in a line by their little necks, and the posterior cell not being a terminal one."

This is substantially my account of *Lagena lævis* in my first paper, and I can truly say, that Mr. M'Coy's article never came to my knowledge until long after it and the present notes were written. I have scarcely a doubt from the extracts, that these organisms are of a nearly, if not absolutely identical structure with Montagu's *Vermiculum læve*, our *Nodosaria*, and the *Lagena lævis* of authors; they have the same slender strangulations of the nodulous *Lagenæ*, the fragments of which have so long been mistaken for distinct objects. The typical *Nodosariæ* have nothing like the aspect of the very recent lageniform species, first, I

believe, introduced into that genus by myself; the necks of the typical *Nodosariæ* are strangulated, but generally so slightly as scarcely to detract from their strength, and are consequently usually found united.

It has been stated that the rough sketch of *Nodosaria lævis*, in my first paper on the *Foraminifera*, and which had no reference to the exact outline of that species, and was merely intended to illustrate the structure of this organism, has been mistaken by me for a *Nodosaria*, not the *lævis*; I therefore in decided terms state, that the mistake is not with me, and that the fragment which all authors constitute the *Vermiculum læve* of Montagu, alias their *Lagena lævis*, is the true and identical object I have seen in a stem of two, three, and four united nodules with elongated necks.

I exclude the family of the *Miliolidæ*, hitherto and perhaps correctly included in the *Foraminifera*; I have them now under investigation; and will at present only observe, that whatever their position may turn out to be, they are all inhabited by an internal animal, as my observations on the buccal pouches of the *Dentalia* sufficiently prove.

I hasten to conclude with some remarks on the neglect in which this microscopic branch of natural history has long been involved. The causes that have prevented the due consideration of the animals of the *Foraminifera*, and their singularly beautiful organisms, are entirely owing to mistaken ideas of the difficulties attendant on their investigation, the acquisition of the objects, and the supposed injury to the sight by the use of high microscopic powers. These objections I think I shall prove to be ideal, and if we apply the trite aphorism "Omne ignotum pro magnifico" to our case, we shall find that if we devote ourselves determinately to careful examination and investigation, all difficulties will soon disappear, and we shall be surprised at their simple solutions, because in many cases they have assumed the aspect of something miraculous, merely from being enveloped in the meshes of ignorance.

The acquisition of these elegant objects, adorned with sculpture of surpassing beauty, presents no insurmountable difficulties; every shore coated with sands has a certain line which is instantly perceived by the experienced observer, and will furnish a supply of the more common species, and the finer sands of the coralline zone, five or six miles from the shore, by the dredge, will afford abundance of the rarer species. There are also in certain districts marine deposits formed by the subsidence of the waters, which, though of great antiquity, still exhibit the freshness of recent origin without a trace of fossiliferous aspect.

As to the sight being injured by a continuous examination of

these minute objects, I can truly say that this idea is wholly without foundation if the pursuit is properly conducted, and that, on the contrary, it is materially strengthened by the use of properly adapted glasses even of high powers; and in proof I state that twenty years ago I used spectacles, but the continued and daily examination of these minutiae has so greatly increased the power of vision, that I now read the smallest type without difficulty and without aid. The great point to be attended to is not to use a power that in the least exceeds the necessity, not to continue the exercise of vision too long, and never by artificial light, and to reserve the high powers of certain lenses and the microscope for important investigations of very moderate continuance: the really observant eye seizes at a glance the intelligence required, whilst strained, poring, and long optical exertions are delusive and unsatisfactory, and produce those fanciful imaginations of objects which have really no existence. The proper time for research after microscopic objects is for *one* hour after breakfast, when we are in the fittest state for exertion.

The very minute *Foraminifera* are always in fine sand, and the best way to find them is to take from the parcel of sand only as much as will lie on the point of a very small penknife blade, spreading it by a slender-pointed cedar stick on a large card, covered with dull black paper, when, with a proper lens, the objects by their symmetry and beauty are at once distinguished, and gathered up by a sable brush into proper receptacles. This apparently slow but sure mode of finding these minutiae by purely optical exertions will produce a greater supply than by the wholesale immersion of sand in water and the resulting collection of a few buoyant objects; for after all that can be done by this mode, the sand, when abandoned, will then produce three times the number that have been acquired otherwise. In the search of shells of one-tenth inch diameter, perhaps the plan of immersion may succeed well.

Having disposed of two of the greatest drawbacks in the investigation of the *Foraminifera*, it only remains, as concisely as possible, to conclude the present paper by some remarks illustrative of my views in being anxious to rescue this branch of natural history from its present, I may say, retrograde position, as regards the knowledge of the animal.

The field of the British testaceous mollusca has been for many years so sedulously cultivated, that although its products are not yet exhausted, they have nevertheless become so much diminished, as is proved by the increasing far-betweens in the discovery of new species, as to render it almost a matter of necessity to look out for "fresh woods and pastures new;" and where can we find a more delightful resource, partaking so much of the

same character of our accustomed researches amongst the mollusca? Indeed the two pursuits will march in line, as the rescue from their present neglected and false position of those beautiful microscopic structures the Foraminifera, which have nearly run the gauntlet through the invertebrate portion of the order of nature in search of a resting-place. These objects are not only interesting to the mere collector, as they admit of an indefinite preservation without diminution of their singular structural and sculptural elegances, which, with lenses of ordinary powers, can be so well observed if they are properly mounted; but to the geologist the examination of these microcosms and the constructors thereof, and the bringing to light the vast numbers of still undiscovered species, are objects of the highest interest and greatest importance to assist in the solution of many intricate problems, relative to the structure, conditions, and changes of the crust of our globe.

To accomplish the important views I have endeavoured to sketch, and to infuse life, activity and interest into this portion of zoology, nothing more is required than a point of departure, which can only be effected by an energetic naturalist imbued with the "divinus afflatus," and whose years are not numbered as mine, who will undertake the useful and delightful task of giving a start, or rather an impetus to the present dormant position of this section of natural history, by throwing our indigena into divisions, genera and species, accompanied by faithful figures. As to classification, the work would be very light. We cannot adopt one characterized more concisely and distinctively than that of M. D'Orbigny, which I believe will prove more than sufficiently comprehensive for our hitherto discovered species. His first prodrome, the Foraminifera, 'Voyage dans l'Amérique méridionale, de l'île de Cuba, des îles des Canaries,' &c. &c., must form the bases of the classification. The mere substitution of one artificial system for another will be of no advantage to this branch of science, which, from its malacological neglect, must remain for some years in an unsatisfactory position, until the animals are more thoroughly investigated; and when that is done, the membranous sac, the continuous tube, the lobes from one to twenty or more, and the terminal tentacula, will form the main features of all the animals of this class, except perhaps a small section of the *Stichostegida*, and possibly the *Miliolida*; these two latter points I fully expect in the approaching summer, with the aid of the coralline zones of the South Devon coasts, to settle in such manner as will be conducive to the interest of this branch of zoology.

The principal labour would be the collection of the British articles from various cabinets; and who will hesitate to offer the

necessary contributions from his stores in furtherance of such objects, if undertaken under favourable auspices and competent qualification?

I have opened a new field for exertion, particularly for the younger naturalists, in which honour is to be acquired, and furnished in the higher walks of observation,—a new theme, and I trust that the “*Hanc exorna*” will be carried out with a zeal correspondent to the importance of the subject.

I am, Gentlemen, your most obedient servant,
WILLIAM M CLARK.

XVII.—*On the Watery Secretion of the Leaves and Stems of the Ice-plant* (*Mesembryanthemum crystallinum*, L.). By Dr. AUGUSTUS VOELCKER, Prof. of Chemistry Royal Agricult. College, Cirencester*.

A FEW months ago I had the pleasure of communicating to the Botanical Society of Edinburgh the results of an examination of the watery liquid in the ascidia of *Nepenthes destillatoria*. Those present at the meeting, as well as the readers of the ‘Annals of Natural History,’ will remember that, in opposition to the statements of most botanists who have directed their attention to the subject of the watery secretions of the leaves of plants, I found the liquid in the ascidia of *Nepenthes* to differ materially from pure water, inasmuch as it contained from 0·30 to nearly 1 per cent. of solid substances, partly organic partly inorganic. I stated at that time my doubts as to the watery secretion of plants being nothing but pure water, and gave some reasons for this opinion; Prof. Balfour, with whom I discussed the subject, kindly furnished me with the means of investigating this point still further by favouring me with fresh specimens of the curious Ice-plant (*Mesembryanthemum crystallinum*), a plant which is remarkable on account of the gland-like vesicular eminences with which its leaves and stems are covered. The result of the examination of the fluid secreted by the leaves of this plant has fully confirmed the opinion expressed in regard to the watery secretions of plants; at all events it has shown me that the secretion of the leaves of the Ice-plant is not merely pure water, but water containing several substances in solution. Though I was unable to determine quantitatively the composition of this secretion on account of the small quantity of liquid at my command—a quantity insufficient even for a minute qualitative analysis—yet I had no difficulty in detecting the chief constituent parts of the fluid. The secretion I procured by lacerating the gland-like eminences with

* Read before the Botanical Society of Edinburgh, Jan. 10, 1850.

which the leaves are covered, with a needle, and collecting the fluid in a glass bottle. The fluid thus obtained was colourless and nearly clear, without smell, and possessing no distinctly pronounced taste. Litmus-paper dipped in it was very slightly turned red, showing the presence of merely traces of a free acid or an acid salt. In order to free it entirely from any particles of epidermis which might accidentally have mingled with the liquid, I filtered it through white filtering-paper. The fluid passing through the filter slowly was now perfectly clear. On heating to 212° F. white flakes were separated, which proved to be identical with vegetable albumen. They were collected in a filter, and the filtrate evaporated to dryness on a water-bath. During the evaporation the liquid turned yellow, particularly when evaporated to a small bulk, and left a brownish-coloured, very hygroscopic residue, which redissolved in a small quantity of distilled water, leaving but a trace of a humus-like, dark-coloured organic substance undissolved.

The chemical nature of the fluid from which the albumen had been separated, was ascertained as far as possible by the following tests:—

Ammonia produced no change.

Carbonate of ammonia gave no precipitate.

Carbonate of soda on boiling gave a white precipitate.

Oxalate of ammonia produced no change.

Phosphate of soda and ammonia, added to the concentrated liquid, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the concentrated liquid after the removal of the magnesia, produced a crystalline yellow precipitate.

The presence of soda was indicated by the yellow colour given to the alcohol flame.

Lime-water produced a white precipitate.

Sulphate of lime likewise produced a white precipitate.

Chloride of barium gave a heavy white precipitate.

Nitrate of silver gave a white flaky precipitate, soluble in ammonia, but insoluble in nitric acid.

Acetate of lead produced a white precipitate.

Basic acetate of lead gave a voluminous white precipitate.

A portion of the water evaporated to dryness and heated to redness left a white ash which effervesced with acids, indicating the presence of carbonates, originated from organic acids present in the fluid.

The nature of the organic acids, which in all likelihood accompanied the oxalic acid, I could not determine from want of material. The presence of oxalic acid however is distinctly indi-

cated by the above reactions. They likewise show the presence of chloride of sodium, potash, sulphuric acid and magnesia.

In comparing this secretion of the leaves of the Ice-plant with the fluid in the ascidia of *Nepenthes*, we find a material difference in their respective compositions, as will be seen by the annexed table, which exhibits the composition of both fluids. :—

<i>Composition of the fluid in the ascidia of Nepenthes.</i>	<i>Composition of the watery secretion of the leaves of Mesembryanthemum crystallinum.</i>
Organic matter, chiefly malic and a little citric acid.	Organic matter (albumen, oxalic acid, &c.).
Chloride of potassium.	Chloride of sodium.
Soda.	Potash.
Line.	Magnesia.
Magnesia.	Sulphuric acid.

XVIII.—*On the Anatomy of the Freshwater Bryozoa, with descriptions of three new Species.* By ALBANY HANCOCK, Esq.*

[With four Plates.]

DURING a ramble made last July in company with “The Tyneside Naturalists’ Field Club” to the Northumberland lakes, I was fortunate enough to find two or three species of *Bryozoa*. Since then I have revisited the locality twice, and on each occasion additional species occurred. Thus six or seven forms of these interesting animals have been found to inhabit two of these lakes, namely Bromley Lough and Crag Lough. Three of the species appear to be undescribed; these I propose to characterize towards the close of this communication, giving previously an account of the anatomy of the freshwater *Bryozoa* so far as I have been able to determine it.

Amongst the known species was a fragment of *Alcyonella*, most probably *A. stagnorum*; but its characters could not be determined on account of the imperfection of the specimen. *Fredericella sultana* occurred abundantly and of very luxuriant growth, spreading over the under surface of stones in patches of three or four inches’ extent. Of the new species two belong to *Plumatella* and one to *Paludicella*, a rare genus, of which there was but one species previously known, and that I believe had been found only in Ireland, and in two or three localities on the continent.

The anatomy of the freshwater *Bryozoa* had been very little studied on this side of the Channel before Professor Allman took up the subject, and he has handled it so well that little is left to

* Read at a Meeting of the Tyneside Naturalists’ Field Club, Dec. 1849.

be done. Indeed so complete are the results of this naturalist, that, perhaps, the publication of my own may appear almost unnecessary. My investigations, however, carried on as they have been perfectly independent of the researches of others, may not be without some value even where novelty is wanting. Microscopic investigations conducted by the aid of transmitted light are liable to error. Frequent examinations in such cases are therefore necessary, and observations independently prosecuted are of peculiar value. Consequently I do not hesitate to give the result of my own labours on this subject, fraught as it is with difficulty, not fearing to mislead in a path already so well trodden.

Of the anatomy of these animals I shall have to confine myself almost entirely to that of *Plumatella*, *Fredericella* and *Paludicella*. Of *Alcyonella* I can say but little, having seen only an imperfect specimen, and none of the other freshwater forms have come under my notice.

Plumatella and *Fredericella* resemble each other very closely in their anatomical structure, notwithstanding the external difference of their polypes. *Paludicella* however shows some very interesting modifications, particularly in the muscular system: but before entering on the internal anatomy it will be necessary to examine the characters of the polypidom, and to trace its relationship to the polype.

The polypidom of *Plumatella Allmani*, Pl. V. figs. 3, 4 & 5, and of *Fredericella sultana* is tubular, branched and carinated on the upper surface; the walls opaque, tough and membranous, inclining to horny. Those of the latter, when examined through the microscope, exhibit a sort of dendritic structure; the divisions or branches passing in an irregular spiral direction round the tube, are flattened, and extensively anastomosing form for the most part a dense tissue, nowhere more open than just to display the branched character. The walls of *Plumatella* do not in the least exhibit this structure. In *Paludicella* the polypidom, fig. 2, is likewise branched and tubular, but not carinated; it is membranous or horny, and becomes enlarged and contracted at certain intervals, dividing the whole, as it were, into cells or compartments, the external surface being smooth and very glossy.

All these genera have the polypidom lined with a delicate membrane—the tunic, Pl. III. figs. 4 *b*, *b* & 5 *k*, and Pl. IV. fig. 1 *b*, which is attached only at certain points to the inner surface of the external tube or cell-wall. This in *Plumatella* and *Fredericella* becomes excessively delicate towards the orifice, where it apparently blends with the tunic. But in *Paludicella* the union at this point of the horny wall and tunic cannot be mistaken, though the blending is so gradual that it is impossible to say where one ends and the other begins. And when this polype is

exserted, there is a delicate membranous cup, Pl. IV. fig. 1 *d*, projecting upwards from the inner surface of the mouth of the cell. This cup is the homologue of the circle of setæ surrounding the aperture of *Bowerbankia* and other marine genera. In *Paludicella* the tunic is sprinkled with large nucleated cells, fig. 4 *m*, and at certain intervals bends abruptly inwards, figs. 1 & 2 *u*, *r*, dividing the polypidom into cells at the points indicated by the constrictions in the horny tube. Thus each polype is isolated, is contained in fact within a distinct membranous cell, the end-walls of which abut against the end-walls of the adjoining cells. The divisions are therefore double, and being of living membrane and in contact, it is probable that all the inhabitants of the polypidom are in some degree connected in vital action. The end-walls are considerably thickened in the centre, forming a bulb or boss projecting into the cell. The polypes of *Fredericella* are not separated the one from the other, though a few divisions appear to exist at distant points. Thus it would seem that groups of animals are associated together as it were in one tube. Neither in *Plumatella* are the polypes separated.

The polype lies in the longitudinal axis of the cell, Plates II. & IV. figs. 2, 2, being provided with numerous muscles for protrusion and retraction. It is held in its place principally by a membranous tube—the tentacular sheath, Pl. II. fig. 2 *m*, *n*, and Pl. IV. fig. 2 *d'*, *d'*, which blends with the inverted lips of the tunic, Pl. II. fig. 2 *l*, a little below the orifice of the cell, and continuing downwards within the cell incloses the bundle of retracted tentacles, and is attached round the tentacular disc *a'*.

Digestive System.—The organs of digestion, comprising nearly the whole of the polype, float freely in the visceral cavity. The entrance to the alimentary canal is furnished with tentacles, Pl. II. fig. 1 *b*; these arise from a margin surrounding the oral opening in two different fashions; in the one they form a complete circle round the mouth, in the other they are arranged in a crescentic manner, the limbs of the crescent being two arms, Pl. III. figs. 1, 2 & 3 *c*, *e* & *c*, extending from the sides of the mouth, fig. 3 *a*, having their bases confluent and with a row of tentacles on their inner and outer margins. *Paludicella* and *Fredericella*, Pl. IV. fig. 1 *f*, and Pl. II. fig. 1 *b*, are examples of the first mode of arrangement; and *Plumatella*, Pl. III. figs. 1, 2 & 3, and *Alcyonella* of the second. In *Paludicella* the tentacles when spread out form a very exact inverted cone, closely resembling the shape they assume in some of the marine species. The base or disc supporting the tentacles is not exactly circular in *Fredericella*; in this genus it is a little flattened at the point corresponding to the space between the oral arms in *Plumatella*; and there is also a delicate transparent membrane, Pl. II. fig. 1

c', *c*, uniting the bases of the tentacles. In these respects *Fredericella* shows an approximation to those with oral arms, or as it is generally termed, a crescentic disc. In these there is always a similar membrane, Pl. III. figs. 1, 2 & 3 *e*, *f* & *d*, at the base of the tentacles, and in all of them, as well as in *Fredericella*, this membrane is attached to the external surface of the tentacles, and is much wider at the margin than the spaces between them, and consequently it bags out, giving to the upper portion a flounced appearance, particularly in the latter, Pl. II. fig. 1 *c*.

The tentacles themselves in all these genera are rather stout and linear with the end obtuse; they have the appearance of being tubular, as have likewise the oral arms of *Plumatella*: the tentacles are clothed with long cilia, which vibrate upwards on one side and downwards on the other in the same manner as described in the marine species; and as in them, when the polype is retracted the tentacles are drawn down in an erect position, having first been brought together into a compact linear bundle, Pl. II. fig. 2 *a*, and Pl. IV. fig. 2 *d*. They do not appear to be at all contractile, and in all the species are transparent and almost homogeneous in their structure. There can be little doubt that they are not merely tentacles, but that they are likewise respiratory organs: food is brought to the mouth by their ciliary currents, and also by the action of the tentacles themselves, one or more of which may frequently be seen bending suddenly inwards, and securing such particles as come within their reach. They occasionally act in concert in the capture of animalcules by bringing their tips together, thus forming, in those with a circular disc, a very elegant oval cage, within which the imprisoned prey may be seen for an instant or two dashing about previously to passing into the œsophagus or to liberation, which not unfrequently happens, the captive proving distasteful to the polype. The tentacles then may be considered prehensile labial or oral appendages, notwithstanding their respiratory function, and as such they are a portion of the alimentary system.

The oral orifice of *Plumatella* is semicircular, Pl. III. fig. 3 *a*, and protected by a strong, rounded, fleshy valve, *b*, which, arising from the side of the mouth at the point on the inner margin of the crescent where the two arms unite, projects upwards and slightly overhangs the opening. This valve is completely under the control of the animal, and can be made to act as a sort of operculum, closing the orifice to prevent the admittance of food; or it can be used to force food into the pharynx. The mouth, Pl. II. fig. 1 *d*, of *Fredericella* is likewise semicircular, and is also provided with a similar valve, *e*. It is immediately behind it that the tentacular disc is a little flattened, proving that this point corresponds to the space between the arms in *Plumatella*; indeed

in some points of view the angles formed by this flattening have not a little the appearance of rudimentary arms just sprouting.

The œsophagus descends at once in a straight line from the oral opening. In *Fredericella*, Pl. II. figs. 1 *f* & 2 *b*, it is rather short and wide, and the walls, which are thick and fleshy, are parallel throughout, except at the commencement, where they are a little bulged, forming a sort of pharynx which is lined with vibratile cilia: the other extremity communicates with the stomach by a distinct valvular orifice, Pl. II. figs. 1 *g* & 2 *c*,—the cardiac, projecting downwards. The whole surface is covered with minute circular cells resembling very much the peculiar structure observed in the marine species, and pointed out by Dr. Farre in his valuable paper on the Marine Ascidian Polypes published in the 'Philosophical Transactions' for 1837.

The stomach, figs. 1 *h* & 2 *d*, is more than twice the length of the œsophagus, tapering slightly downwards and truncate above; the lower extremity being obtuse: the walls, like those of the œsophagus, are thick and fleshy, and are covered with numerous, minute, close-set cells of a glandular character. The pyloric orifice is circular and well marked, and has the appearance of being guarded by a sphincter muscle; it is likewise supplied with vibratile cilia which extend some little way into the stomach. This orifice is situated above, at one side and a little below the cardiac opening. The intestine, figs. 1 & 2 *i, e*, is straight, and a little longer than and nearly as wide as the œsophagus, with which it lies in contact and to which it is apparently attached; the pyloric extremity is obtusely pointed, and communicates by the side with the stomach; from thence the intestine tapers a little upwards towards the anal extremity, which, turning outwards, passes through the tentacular sheath just below its attachment to the disc supporting the tentacles, and there terminates in an obtuse perforated point, figs. 1 & 2 *j* & *f*, which can be either protruded or retracted to a considerable extent at the will of the animal. The whole of the alimentary canal is highly irritable, particularly the œsophagus and stomach, in the walls of both of which, minute, transverse striæ are distinctly visible, probably indicating the presence of muscles. The stomach is perpetually in motion when the animal is displayed, contracting in an undulating or vermicular manner from above downwards. The contractions of the œsophagus, too, are very decided on receiving food, which for a second or two rests in the pharyngeal enlargement, and is then hurried to the stomach with great rapidity.

The alimentary canal of *Plumatella* and *Alcyonella* does not vary in any important manner from that of *Fredericella*. In the *Ann. & Mag. N. Hist.* Ser. 2. Vol. v. 12

two former, however, both the œsophagus and stomach are shorter than they are in the latter genus.

In all these genera no disturbance of the parts of the alimentary canal takes place on the retraction of the polype: the animal sinks into the cell with the œsophagus, stomach and intestine erect as they were when the tentacles were exerted and in full play. Not so however in *Paludicella*, Pl. IV. fig. 2; in this genus the alimentary canal is doubled upon itself when the polype is retracted; and moreover the parts are somewhat modified, approximating this form more closely to that of the marine species.

When the animal of *Paludicella* is protruded, the œsophagus, fig. 1 *h*, is observed to be long and slender, and to have a distinct pharyngeal dilatation at the commencement, where vibratile cilia can be seen in vigorous action. It communicates with the upper extremity of the stomach by a circular orifice, fig. 2 *f*. The stomach, fig. 1 *i*, is rather short, considerably enlarged above and tapering to the inferior extremity, where it is rounded: the walls are thick, and apparently filled with yellowish brown coloured granules, probably hepatic as in the marine species. The intestine, *j*, arises from the superior extremity close behind and a little above the cardia. The pyloric opening is well defined and circular; soon after its origin the intestine is suddenly enlarged, forming an oval swelling, *k*, in which the fæces may be seen collecting; it contracts above this swelling, and continues afterwards for nearly its whole length of equal diameter; it passes upwards in a straight line parallel with the œsophagus, but unattached to it, and terminates in a rounded anal extremity, *l*, immediately below the base of the tentacles where it perforates the tentacular sheath. The upper end of the stomach, close to the pyloric orifice, is furnished with vibratile cilia, and here the alimentary matters may be seen rapidly rotating by their influence. The fæces are formed into small pellets, which, coming from the enlarged portion, pass up the intestine and are expelled at the anal orifice. The whole of the canal is as highly irritable as in the other species; the stomach undulating from above downwards in the same manner, and the œsophagus is equally expert in transmitting food to the stomach. But neither in *Paludicella* nor in the species before alluded to does the pharyngeal swelling exhibit in any marked manner the sudden puffings and contractions so conspicuous in the marine species, and noticed originally by Dr. Farre.

On retraction of the polype, the alimentary canal of *Paludicella* is doubled upon itself in much the same way as in *Bowerbankia*. The basal disc of the tentacles is then brought down as far as

the upper extremity of the stomach, and the consequence is that the intestine, fig. 2 *h*, is doubled upon itself a little above the enlargement, *i*, and the œsophagus, *e*, is forced down by the side of the stomach, *g*, and turning upwards again is bent into the form of an S.

Vascular System.—This appears to be entirely wanting in these animals: a species of circulation nevertheless exists. I have seen on two or three occasions a pretty regular flow of the fluid in the visceral cavity of *Plumatella* and *Fredericella*. Under ordinary circumstances no fluid can be recognized in this cavity, from the apparent deficiency of blood-globules or corpuscles of any kind. Such however probably exist, but the thickness and opacity of the cell-walls are sufficient to prevent the detection of minute bodies of this nature. On the occasions alluded to some of the tissues of the animal appear to have been ruptured, and small fragmentary particles mingling with the contained fluid were perceived moving in certain directions. By the aid of these particles, which were numerous and of various forms and sizes, it was easy to ascertain that the fluid which bathes the polype circulates in a regular manner within the cavity in which the viscera float. There can be no doubt that this circulation is caused by the action of cilia which cover the inner surface of the lining membrane or tunic, and also clothe the external wall of the retracted tentacular sheath. The current flowed regularly and steadily; but when the floating particles approached the surface of the tunic or tentacular sheath, their motion became accelerated in a manner that sufficiently evinced the presence of vibratile cilia. Those on the tunic chiefly determined the direction of the current, which went with great regularity up one side, crossed over at the top of the cell, and then went down the other side; it crossed again in an opposite direction a little below the stomach, and so completed the circuit. It was not difficult to ascertain that the cilia of the tunic on one side of the cell vibrate upwards, on the other side downwards; and that all those on the tentacular sheath vibrate upwards. On one side therefore the currents of the sheath and tunic oppose each other; and consequently an eddy was visible near the top of the cell.

It is quite evident then that fluid circulates within the visceral cavity. What is the nature of this circulation? Is it merely respiratory, or is it nutritive? It can scarcely be considered an aërating current, as there is no visible communication between this cavity and the external water; and indeed if an orifice exists, it must be minute and under the control of the animal, or the protrusion of the polype could not be effected in the manner to be afterwards described. It is more likely to be for the purpose of nutrition,—standing, indeed, in the place of a vascular system.

The fluid must therefore hold in suspension the products of digestion. These may be supposed to exude through the walls of the intestinal canal, probably from the enlarged portion of it in *Paludicella*, and perhaps also from the upper portion of the stomach; and passing into this circulation will go at once to nourish the various organs of the animal, all of which are bathed with this vivifying fluid, except the tentacles, which we shall afterwards see, in all probability, receive blood into their interior for the purpose of aëration. In this way, too, we can understand the nourishment and growth of the tunic and the maintenance of the buds (which germinate from it) until they are able by the aid of their own tentacles to procure food. In no other way can the development of these buds be so easily explained. The membrane in which they take their origin must either be supplied with the nutritive fluid in this way or by the agency of vessels; but none can be discovered either in the tunic or elsewhere. The external cell-walls whilst in a growing state must also be nourished by the tunic, which we have seen is united to the external walls at the orifice of the cell.

The respiratory function we have stated to be exercised by the tentacles, but there can be no doubt that all the exposed parts will assist in aërating the blood. The tentacles are hollow, and though I could not detect any fluid within them, it is probable that the blood finds its way into their tubular cavities through the basal disc; and as they are clothed with strong vibratile cilia which keep a constant flow of the oxygenating medium over their surfaces, they would appear well adapted for breathing organs. It is however difficult to understand how the oxygenation of the blood goes on when the polype is retracted; for at this time the orifice is completely closed by the folding in of the lips of the cell, and by muscles provided for the purpose. Professor Allman has supposed that the tube retractors of *Paludicella* exercise the function also of opening the aperture when in this state for the purpose of admitting the surrounding fluid. But I have seen nothing to warrant such supposition; and indeed the tentacles being then packed close together within the sheath, the cilia cease to vibrate, and there is no room in which the water can flow around them, even supposing an opening to be so maintained. The tips of the tentacles too of *Paludicella* and of several of the marine species when retracted are generally bent down in a manner to forbid the flow of any fluid whatever amongst them. It would therefore seem clear, that when not in action the oxygenation of the blood must almost, if not entirely, cease in these polypes, as it must do in most of the Mollusca when closed up in their shelly armature.

Nervous System.—Some years ago Professor Allman discovered

a ganglion in these animals, and has more recently ascertained the existence of nerves. I have also detected a large ganglion, Pl. II. fig. 1 *k*, in *Plumatella* and *Fredericella*. It is situated just below the entrance to the œsophagus on the external surface, close to the base of the tentacles and just above the anal orifice. It is therefore placed between the oral arms in *Plumatella*, and in *Fredericella* at the corresponding point. In the latter I have observed two or three nerves passing from the ganglion upwards in the direction of the tentacles, and one apparently going to embrace the œsophagus; another that comes from the lower extremity of the ganglion may also be seen passing downwards close to the œsophagus. This is all I have been able to make out respecting the nervous system, though undoubtedly more is to be learnt.

Muscular System.—There are three distinct sets of muscles in *Plumatella* and *Fredericella*; one for the retraction of the polype, another to assist in the act of protrusion, and the third probably accessory in closing the orifice. The first and most conspicuous set of muscles, the polype retractors, Pl. II. figs. 2 *g*, *g* & 4 *f*, and Pl. III. figs. 4 *g* & 5 *i*, *i*, is divided into two equal bundles, one passing on each side of the polype. These bundles are composed of numerous, stout, isolated fibres, having their origin in the walls of the cell a considerable way below the retracted polype; and passing upwards have their superior extremities inserted at the tentacular disc or base of the oral arms and at the upper portion of the œsophagus. There are also two similar bundles of muscular fibres in *Alcyonella*, but in this genus they have their origin at or close to the bottom of the cell. When the animal of *Plumatella* is exerted, two or three of the stoutest, Pl. II. fig. 4 *g*, of these fibres are seen to be attached on each side further forward than the rest at the base of the oral arms. Also in *Fredericella* similar fibres are inserted at the corresponding parts of the tentacular disc. These stout fibres have their origin a little lower down the cell than the rest.

The function of these two bundles of muscular fibres cannot for a moment be mistaken: they are for the purpose of drawing the polype back into the cell; and when it is so withdrawn, the fibres of this, the most powerful muscle of the animal, may be seen in a relaxed state and bent upon themselves in a loose undulating manner about the tentacular disc and downwards to their origin. The few strong fibres alluded to undoubtedly assist in the retraction of the polype; but are also apparently the principal agents in rotating the head, so to speak, of the polype when exerted.

The second set of muscles, Pl. II. figs. 1 & 2 *m*, *h*, is composed of a circle of stout, isolated, radiating fibres, all placed in the

same horizontal plane, considerably apart from each other, and attached by their outer extremities to the inner surface of the tunic some way below the opening; their inner extremities converging towards the tentacular sheath are attached to it about one-third from its superior termination. *Plumatella* has fifteen or sixteen of these fibres, *Fredericella* about fourteen. Their arrangement is perfectly symmetrical. They are for the purpose of preventing the inversion of the whole of the tentacular sheath on the protrusion of the polype; and thus to confine the oral extremity within a convenient distance above the mouth of the cell.

The true value of these muscles will be fully understood if we refer to the marine genus *Bowerbankia*, in which they are deficient, and of course the tentacular sheath can be completely inverted, and accordingly the animal is enabled to reach to a greater distance than it could otherwise have done. But an apparatus of extraordinary beauty is provided to obviate the inconvenience that must have arisen from the great elevation of the tentacular disc above the support of the horny cell. This is effected by what may be considered an elongation upwards of the cell. Numerous setæ bound together by a membrane are attached to the lips of the orifice, so that when the polype is exerted they stand up in a circle surrounding the lower part of the exposed portion of the animal and give support to it. By this means the far-outstretched tentacular disc is brought completely under the control of the muscles for directing its movements*. We thus clearly see that this set of radiating muscles is a compensation for the deficiency of the circle of setæ in the freshwater polypes.

The third set of muscles, figs. 1 & 2 *n, i*, consists of numerous, separate, fine thread-like filaments placed considerably apart, without order, but in the same radiating manner as those last

* Dr. Farre has described this apparatus in his paper so frequently referred to, but seems scarcely to have arrived at a full knowledge of its function. He considers that it is "for allowing of the freest possible motion to the upper part of the body in its expanded state, to which it affords at the same time support and protection." On examining the animal in action it is evident that the use of the apparatus is as I have pointed out. The circle of setæ is then seen to compress the lower portion of the extended polype; and when the tentacular disc moves from side to side the neck always bends from the top of the setæ at a decided angle, and does not gradually arch away from the lips of the cell as might be expected were this contrivance for the purpose of giving flexibility. The delicate membrane uniting the setæ is strengthened with numerous, minute transverse fibres, forming the whole into a powerful sphincter, thus giving great firmness to the part. By this arrangement *Bowerbankia* is enabled to raise the tentacular disc far above the polype-cell, and yet to remain as perfectly under the control of the rotatory and retractor muscles as is the tentacular disc of *Fredericella* and *Plumatella*, in both of which it is confined close to the orifice of the cell by the action of the radiating muscular fibres.

described, immediately above them and extending upwards to the termination of the cell. These filaments have their outer extremities attached to the inner surface of the tunic; and converging towards the axis of the cell, their inner extremities are attached to the upper portion of the tentacular sheath and the inverted margin of the tunic. These fibres are equally numerous and fine in both *Plumatella* and *Fredericella*, and appear to be for the purpose of assisting in closing the orifice, acting in harmony with the contraction of the upper portion of the tentacular sheath and the inverted lips of the orifice. They may, acting in the opposite direction, also assist in opening the channel, but the tentacles themselves would appear quite adequate to force a passage on the relaxation of the contractions about the orifice. The function of these fibres is in fact to keep in unison the tunic near the opening and the upper portion of the tentacular sheath.

The upper portion of the tentacular sheath and inverted lips of the tunic are highly contractile, and it is by their agency principally that the orifice is closed when the animal is retracted. I have not however been able to detect any muscular fibres for the purpose, though at the point, Pl. II. fig. 2 *n*, where the inverted lips of the tunic join to the tentacular sheath, it is suddenly constricted as if by a powerful sphincter muscle. In fact the whole of the tunic is undoubtedly contractile, yet in no part of it have I detected muscular fibres. By the contraction of this lining membrane the capacity of the visceral cavity is diminished; and thus by the pressure of the contained fluid the protrusion of the polype is effected. This matter however will be discussed more fully when we come to speak of this portion of the anatomy of *Paludicella*.

To understand the combined action of the various sets of muscles in *Plumatella* and *Fredericella*, we have only to watch the animal when about to issue from the cell. The first change observed is the contraction of the tunic, Pl. II. fig. 4 *j, j*, and Pl. III. fig. 4 *b*, the walls of which are brought nearer together towards the lower portion of the cell. The pressure thus occasioned on the contained fluid compels the polype to begin its ascent; at the same time the sphincter contraction of the upper portion of the tentacular sheath relaxes, so that the bundle of tentacles can force their way without difficulty. As the polype gradually advances upwards the circle of strong radiating muscles comes into play, and it is a sight of no little interest to watch them drag upon the tentacular sheath, allowing the inferior portion of it to roll upwards attached to the tentacular disc. As soon as the ascent is arrested by these muscles, the sheath being inverted as far as they will permit, protrusion is complete, and the tentacles at once assume their proper arrangement.

The muscular apparatus of *Paludicella* differs in some respects from that of *Plumatella* and *Fredericella*. In the former there are six sets of muscles—three in connexion with retraction, two with protrusion, and one for closing the orifice on the retreat of the polype. Of the retractors one set acts directly upon the animal, the other two upon the tubular orifice of the cell. The former set, Pl. IV. fig. 1 *o*, the most powerful in the animal, is similar to the tentacular retractors of Dr. Farre: it differs only from the polype-retractors in *Plumatella* and the other genera already spoken of in not being divided into two bundles. It is composed of numerous, stout, long, linear fibres originating from the inner surface of the anterior wall of the cell more than half-way down; then passing up in front of the polype the superior extremities are inserted around the base of the tentacular disc. These fibres draw the polype down into the cell, and like those of the same muscle in the other *Bryozoa*, when unemployed lie in a somewhat cramped and disordered state, fig. 2 *l*, *l*.

The second and third sets of muscles are the tube-retractors; the former or inferior, figs. 1 *p* & 2 *m*, *m*, is much the larger; it is composed of four compressed bundles of stout, linear fibres placed close together, but distinct from each other. These bundles are associated together in pairs, one on each side of the tube; the inferior ends of these pairs of bundles arise wide apart from the posterior wall of the cell opposite the orifice. As they pass up the tube the bundles converge, and reaching within a short distance of the lips of the orifice, they are inserted upon the inner surface of the tube-walls at four opposite points; the fibres of each bundle being attached one above the other in the same longitudinal plane. This peculiar arrangement causes the margins of the orifice to fold into four portions on the retraction of the tube; and its end, fig. 3, consequently assumes a square form, the angles corresponding to the insertions of the muscular bundles.

The third set of muscles, figs. 1 *q* & 2 *n*, *n*, the superior tube-retractors, are made up of only four fibres, two on each side of the cell, having their origin immediately below that of the set just described; their other ends are attached to the inner surface of the tube above the insertion of the inferior set, and at the base of the membranous cup, fig. 1 *l*, before alluded to, at the mouth of the cell. The inferior and superior tube-retractors are homologous to the double set of opercular muscles described by Dr. Farre in the marine species, differing only from those in *Bowerbankia densa* by being divided into four bundles instead of into three as they are in that species. The action of these muscles is obvious. The superior retractors, having their insertion at the base of the membranous cup at the mouth of the cell, draw it down base first in the axis of the tube, at the same time folding

in around it the lips of the cell. The inferior set then taking up the work complete the inversion of the tube. Dr. Farre, however, supposed that the opercular muscles were not merely for drawing the tube in after the retreating animal, but also for the purpose of closing the orifice. Professor Allman has pointed out the error of this opinion, and endeavoured to explain the closing of the orifice by the pressure of the fluid within the cell against the walls of the inverted tube. We shall directly see, however, that this theory is unnecessary, there being special muscles provided for the purpose. Professor Allman is likewise disinclined to believe that the opercular muscles are really tube-retractors, as he supposes the muscles for drawing in the polype are sufficient for the purpose also of drawing in the tube. Were these latter muscles used to invaginate the tubular orifice of the cell, we should expect to find them in action so long as the animal was retracted; but we have already seen, that when the polype is in this state, they are invariably relaxed and lie in a disordered undulating manner, perfectly at rest. The tube-retractors on the contrary are always tense and in vigorous action during the retracted state of the polype, evincing I think in a satisfactory manner that their function is to retract the tube and to maintain it in an invaginated state,—unless we are to suppose that they are constantly employed in keeping open the channel as suggested by Professor Allman. They will certainly have a tendency to pull asunder the walls of the inverted tube, yet I have never seen the channel thus opened, although these muscles are never otherwise than as represented in Pl. IV. fig. 2, when the polype is retracted. And moreover the tips of the tentacles, as exhibited in this figure, are frequently doubled down, showing that the tentacular sheath must be to some extent relaxed, and that there is no stress whatever on it, as there would be were the polype-retractors used to draw in the orifice.

The fourth set of muscles to be described is for closing the orifice. This set is composed of two sphincters: one, fig. 2 *o*, of these is made up of several fibres passing round the tube at the place of insertion of the inferior tube-retractors, and is of considerable breadth; the other, *p*, is formed of only two or three fibres, which encircle the same tube at the insertion of the superior tube-retractors. The action of these sphincters cannot be mistaken; they effect the closing of the orifice on the retraction of the animal; being at the same time antagonistic to the opening tendency of the tube-retractors, which, diverging from their insertions, must in some measure bring the walls of the inverted tube asunder. These sphincters are not readily distinguished, but having seen them in several individuals, I have not the slightest doubt of their existence. Deeming however that it would be

satisfactory to see whether a similar apparatus for closing the orifice could be found in the marine species, I examined specimens of *Bowerbankia*, and had the satisfaction of detecting sphincter muscles in the same situations. At the point of insertion of the inferior tube-retractors—according to Dr. Farre of the upper set of opercular muscles—the circular fibres are very distinct and numerous, forming a large portion of the inverted tube into a broad sphincter. These fibres are so conspicuous that it seems strange how they could have escaped the notice of so close and accurate an observer as Dr. Farre. It is possible enough, however, that they might be less developed in the species examined by him*. The sphincter at the point of insertion of the superior tube-retractors is not readily observed; but when the polype is exerted there can be no doubt of its existence.

The fifth set of muscles, figs. 1 & 5 *t, h*, is in connexion with the tunic or lining membrane of the cell, and is precisely similar to the parietal muscles described by Dr. Farre in the marine species. This set is formed of short, transverse belts, arranged in pairs, considerably apart from each other, which are to be found almost from end to end of the cell, but most conspicuously towards the lower extremity. There appears to be two sets of these fibres, one down the back, the other down the front of the cell; but I could not arrive at any very satisfactory conclusion respecting their arrangement, neither could I determine their exact relationship to the tunic,—whether they are attached to it by their extremities only as supposed by Dr. Farre, or connected with it throughout their entire length. Professor Allman appears to be of the latter opinion, and certainly I saw nothing in confirmation of that expressed by Dr. Farre; though I am not sure that the extremities are not attached to the cell-walls, thus giving to these muscular belts fixed points of action. Howsoever this may be, these parietal muscles undoubtedly have the power of contracting the tunic, and so lessening the space within which the polype is confined; the contained fluid is made to press on the surface of the polype, constraining it to pass upwards, and thus to effect its

* In the species examined by Dr. Farre and named by him *Bowerbankia densa*, the tube-retractors have a "triradiate arrangement," and consequently the orifice is puckered into three folds when the polype is retracted. The species referred to in the text we have seen has four such folds—the tube-retractors being divided into as many bundles. The circle of tentacles also assumes a different form in the two species: in that examined by me the tentacles rise from the disc in a straight, slightly diverging line, and arch considerably outwards at the tips. In Dr. Farre's species they arch outwards immediately above the disc, and are very little recurved at the tips. It is therefore pretty evident that there are two species, and that *B. densa* should not be merged in *B. imbricata*, which is most probably the form that I have seen.

protrusion much in the same manner as in *Plumatella* and *Fredericella*. In these however there is some little difficulty, the cells being continuous; but in *Paludicella*, in which they are all separated, this act can be clearly understood. I have certainly observed in *Plumatella* and *Fredericella* the appearance of divisions here and there, forming as it were the cells into groups or systems, but nothing to warrant the belief that each cell is isolated. It might therefore be thought that protrusion of a few of the polypes would necessitate that of the others, or at least would cause an inconvenient pressure on the other members belonging to the same group.

It is difficult to arrive at a full explanation of the propulsion of the polype in these cases; but there can be no doubt that in them, as in the other *Bryozoa*, the contraction of the tunic is the sole agent. Dr. Farre believed that the act of protrusion did not so much depend on the contraction of the tunic as on the straightening of the alimentary canal, which in the marine species and in *Paludicella* is doubled upon itself when the polype is retracted. But in *Plumatella*, *Fredericella*, and *Alcyonella* it is always straight; in these genera, therefore, protrusion cannot in the least be assisted by the alimentary canal. Professor Allman has referred to this fact to prove the error of Dr. Farre's opinion; and indeed, if it be allowed, and I suppose it must, that the pressure of the fluid maintains the protruded animal in its position, it is more than probable that the same power would be sufficient to perform the act of protrusion. From the movements of the alimentary canal it is pretty evident that it has the power of straightening itself: but when quite straight only a portion of the tentacles would be protruded beyond the cell; and here they would remain, for it is very clear that whether straight or bent, the alimentary canal will displace the same quantity of fluid, and that there would be no increase of pressure to force the animal upwards. It is at the moment when the alimentary canal is being straightened that the parietal muscles come into play, and compel the animal to rise above the cell: these acts are perfectly simultaneous. The protrusion therefore of the polype with a bent œsophagus and intestine is effected in the same manner as that in which these organs are straight; only that in the former it is accompanied with the straightening of the alimentary canal.

The sixth and last set of muscles to be described is for the purpose of preventing the entire eversion of the tentacular sheath. This set, Pl. IV. figs. 1 *r*, *r* & 2 *q*, *q*, is the homologue of the strong radiating muscles in *Plumatella* and *Fredericella*; but the fibres are much less numerous. In *Paludicella* they are only four in number, and take their origin from the inner surface of the

cell, two in front immediately below where the tube joins the cell, and two behind in a line with the upper wall of the tube; hence the fibres are placed in front of and behind the polype, and are inserted into opposite points of the tentacular sheath a little way below its summit, having on each side of them the two bundles of the tube-retractors. In the retracted state of the polype these fibres are seen passing downwards towards their insertion. When the polype is protruded these muscles cause the sheath to double upon itself, and thus retain a portion of it within the tube; but not to the same extent as in *Plumatella* and *Fredericella*. It has already been pointed out that in these genera this set of muscles compensates for the want of the circle of setæ which surmounts the orifice in the marine species. In *Paludicella*, however, we have already seen that there is a wide, delicate, membranous cup which rises from the inner surface of the tube a little within the orifice. This cup is undoubtedly the homologue of the circle of setæ alluded to, but in a very rudimentary state, and probably of little or no functional utility: consequently these muscles are still present, though, as might be expected, not so fully developed as in those genera entirely deprived of this appendage.

We have now gone through the whole of the muscular apparatus for retraction and propulsion, and to verify the use of the various sets of muscles, we must once more observe the animal while issuing from the cell. The first symptom indicative of the polype's inclination to come forth is the contraction of the parietal muscles, causing the tunic in certain places to leave the walls of the cell, particularly towards the lower portion; on this the polype commences to move up the cell, and at the same instant the tube-retractors relaxing the inverted lips of the orifice begin to be evolved, and as the contraction of the parietal muscles goes on the polype advances upwards, and more and more of the tube is turned out, in the manner of the eversion of the horn of the common snail; at length the membranous cup makes its appearance, not doubled upon itself, but in an erect position—the margin first, just as the circle of setæ is exerted in *Bowerbankia*. The cup at first is laterally compressed, having been packed longitudinally in the axis of the tube: the tips of the tentacles now emerge through the centre of this cup, and as they pass upwards pressed together in a line side by side, its lateral folds give way, and by the time that the tentacular disc has reached the mouth of the cell, the cup is perfectly expanded. The muscles preventing the entire eversion of the tentacular sheath may now be seen in action near the upper extremity of the tube, holding back the membranous sheath and causing it to roll upon itself. The polype is now fairly above the mouth of the cell, and as the tentacles ex-

pand it has attained its greatest elevation; the cilia then commence to play, and all kinds of particles are hurried towards the mouth.

The retraction of the polype is instantaneous, so rapid indeed that it is quite impossible to follow with the eye the actions of the muscles;—such is the velocity with which this feat is performed, that from complete protrusion to invagination nothing can be perceived but the settling of the polype upwards, after having apparently been dragged too far down the cell. It is not difficult however to understand how the act of retraction is accomplished; the operation of the muscles will be reversed. First the parietal muscles must relax, allowing the tunic to assume its place close to the cell-walls; at the same instant the polype-retractors will contract, and as the animal sinks into the cell the superior tube-retractors will also contract; next the inferior tube-retractors will come into play; and finally, after retraction is complete, the sphincters will close the orifice.

On comparing the muscular system of the freshwater *Bryozoa* with that of the marine forms, a great similarity is observed; some interesting modifications however are deserving of notice. The most remarkable of these are found in connexion with the orifice. In *Plumatella* and *Fredericella* there is no tubular invagination on the retreat of the animal; the tunic is certainly doubled upon itself for a short distance within the orifice, but it remains permanently so. *Paludicella* on the contrary has the walls of the tubular orifice invaginated to a considerable extent when the polype is retracted, and when protruded nearly the whole is evolved. But *Bowerbankia* and other marine forms differ from the freshwater species in having the mouth of the cell completely unrolled when the polype is protruded, the same having been invaginated to a great extent when it was retracted. Thus in the first and last modifications we see the extremes of variation, and consequently the most extensive alterations in the muscular arrangements of these parts. *Paludicella* being in a middle state has the muscular apparatus to some extent of both; and in this respect connects the freshwater with the marine forms.

The tube-retractors are wanting in *Plumatella* and *Fredericella*, and are present in *Paludicella* and in all the marine species, being most developed in the latter. Neither in these nor in *Paludicella*, however, is there anything like the small radiating muscles near the orifice in *Plumatella* and *Fredericella*; and the marine species, too, are destitute of the large radiating muscles in connexion with the tentacular sheath. These, though present, we have seen are less developed in *Paludicella* than in *Plumatella* and *Fredericella*, the former resembling *Bowerbankia* in having a cup at the mouth of the cell. The polype-retractors are very

similar in all the *Bryozoa*, only those at the inferior extremity of the stomach in the marine species appear deficient in the freshwater forms. They all have, however, one or more appendages to this part, but these we shall afterwards see are most probably connected with the reproductive system. The parietal and sphincter muscles are common to both *Paludicella* and the marine forms. On the whole, then, in the muscular system as well as in the digestive apparatus, *Paludicella* shows a close relationship to *Bowerbankia* and its congeners; and is, in fact, an intermediate link between them and the other freshwater *Bryozoa*. Even the minute structure of the muscles themselves would seem to confirm this. In all they are composed of transparent, linear fibres separated from each other and apparently homogeneous. When broken they become irregularly nodulous; but I have not succeeded in detecting transverse striæ observed by Professor Allman, probably from having used insufficient magnifying powers. The small knot-like swelling so remarkable in the centre of the fibre of the marine species is not to be found in either *Plumatella* or *Fredericella*; in *Paludicella*, however, I have observed it in the parietal, but in no other muscles.

Reproductive System.—In the freshwater as in the marine *Bryozoa* there are two methods of reproduction,—one by buds, the other by eggs. The buds always germinate from the same part of the cell, hence the definite form of the polypidom. In *Fredericella* the germ is found in connexion with the inner surface of the tunic not far below the orifice of the cell on its lower side. As the bud enlarges the wall bulges, showing externally the appearance of a new shoot. At first the bud, Pl. II. fig. 3 *a*, is small and oval, and is attached for nearly its whole length; it, fig. 2 *o*, soon becomes irregular in form, with the upper portion broad and somewhat bifid, the lower extremity prolonged: the upper portion then gradually exhibits a circle of short rudimentary tentacles, fig. 4 *l*; and the lower end is seen to be divided longitudinally into œsophagus and intestine, fig. 5 *b*, *d*, continuous at their lower extremities, which still elongating form the stomach, figs. 4 *m* & 5 *c*. To this is seen an appended filament binding it below to the wall of the cell. Imbedded in this filament there is a large, distinct globule with nucleus and nucleolus: this we shall afterwards learn is the incipient ovum, figs. 4 *o* & 5 *e*, lying in the ovary. The polype-retractors, figs. 2 *q* & 4 *n*, now make their appearance, passing from the tentacular base to the side of the cell formed apparently out of the lower portion of the original attachment of the bud; the upper portion of this attachment dilating becomes the tentacular sheath, fig. 2 *p*, into which the tentacles are gradually insinuated as they are developed. The polype being now, as it were,

sketched out within the cell of the parent, its own chamber rapidly forms, and in the course of a day or two, the muscles in connexion with the orifice being added, the fresh-born member of the community bursts from the extremity of its cell, and is ready to take upon itself the work of its own maintenance.

The development of the bud in *Plumatella* differs in no respect from that of *Fredericella*; and in *Paludicella* there is no very important deviation, except at the commencement of the process. In this the first apparent step in the growth of a new polype is the preparation of a distinct cell for its reception. If the top of the last-formed cell be carefully examined, even before its tenant is fully grown, the lining membrane may be seen terminating in a blind sac, Pl. IV. fig. 4 *b'*, a little below the extremity. Within this extremity will also be observed a membranous sac, *l*; at first the base of this sac is moulded on the convex blind termination of the lining of the old cell. The convexity however soon flattens and the sac rapidly increases in size, the external horny covering becoming at the same time elongated and attenuated. After awhile, an oval, somewhat opaque body, the new bud, fig. 5 *m*, germinates from the inner surface of the lining membrane, *l*. This body is attached by its side to the front wall of the cell, and resembles the young bud in *Fredericella*. A long and very delicate membranous sac, fig. 6 *d*, afterwards the tentacular sheath, is now observed to be forming in contact with and above the oval bud; whilst from the lower extremity filaments, *e*, are seen to be produced which form the polype-retractors. From the upper end of the bud, the tentacles, fig. 4 *d*, soon make their appearance within the lower part of the membranous sheath, *i*; at first very short, no more than the scalloped margin of the cup-formed disc; but rapidly lengthening, fig. 5 *a*, they soon advance more than halfway up the sheath. The polype-retractors, figs. 4 *j* & 5 *g*, by this time are considerably developed, and the retractors, *k*, *i*, of the tube are distinctly visible; the tube, fig. 4 *j*, now begins to bulge, and the inverted margins of the orifice are seen within, united to the upper end of the tentacular sheath: the parietal muscles, *h*, also make their appearance at this time, and the stomach, *c*, intestine, *d*, œsophagus, *b*, and tentacles having all assumed their proper forms, the young animal is ready for protrusion. The buds of *Paludicella*, however, do not all originate from the extremity of the old cell; some sprout from the side, and then a slight swelling takes place on the inner surface of the tunic. The horny sheath soon afterwards begins to bulge, and an external cell being formed with its lining membrane, an oval bud makes its appearance, and development goes on as just described.

It has been long known that these animals propagate by eggs as well as buds; Raspail appears to have described the anatomy

of the egg and the hatching of it, and the subsequent growth of the young polype has been minutely investigated by Sir J. G. Dalyell. But the generative organ remained unrecognised until it was pointed out by Professor Allman. The appendage to the lower extremity of the stomach, considered by Trembley to be muscular, Professor Allman believes to be an ovary: that it is so there can be no doubt, as eggs may occasionally be seen in connexion with it. Appendages of this kind exist in *Alecyonella*, *Plumatella*, *Fredericella* and *Paludicella*, and will probably be found in all Ascidian polypes. In *Plumatella* and *Fredericella* there are however three of these appendages or filaments, Pl. III. figs. 4 *f, d, d*, & 5 *e, e', h, h*, which are all attached to the lowest part of the stomach, and passing down have their other ends attached to the wall of the cell not far from the insertion of the polype-retractors. It is difficult to say whether all three are connected with the generative function, or whether some of them are not muscles for the retraction of the stomach. A bundle of such retractors has been described by Dr. Farre in the marine species, attaching the inferior end of the stomach to the base of the cell; but one of them is generally thicker than the rest, and may probably be connected with the reproductive system. *Paludicella* has two such filaments; one, Pl. IV. figs. 1 & 7 *n, g*, passing in the usual manner from the lower end of the stomach; the other, *m, d*, from the upper. These two filaments are inserted upon the posterior wall of the cell, one a considerable way above the other. When the polype is retracted these insertions are found to be a little above the gastric attachments, and the filaments, fig. 2 *j, k*, doubled upon themselves. These are thick, cylindrical and apparently tubular, and do not at all resemble muscles, and indeed, from the relative position of their attachments, they seem ill adapted for retraction.

In *Plumatella* and *Fredericella*, one, Pl. III. figs. 4 *d, d* & 5 *e, e'*, of the filaments is generally stouter than the other two, and this has frequently an egg, *e, f*, attached to it. When the ovum is much developed, it is difficult to make out its relationship to the filament or ovary; but when quite young, it has all appearance of originating from the interior. On one occasion I observed two eggs in connexion with the ovary, one almost mature, the other only forming. The former, fig. 5 *f*, was attached rather below the middle of the generative organ. When the polype was protruded, this organ dragged forward the upper end of the egg; the other end of it was then seen to be attached to the wall of the cell by the continuation of the filamentous ovary *e'*. A little below the egg there was a slight oval swelling, in the interior of which was seen a nucleated cell, *g*, undoubtedly an ovum in a very early stage of development, and apparently in the interior

of the ovary*. In *Fredericella* a similar nucleated cell, Pl. II. figs. 4 *o* & 5 *e*, has been observed in the appendage to the stomach, while the polype was yet in a very rudimentary state, as exhibited in the bud before alluded to. In this genus I have likewise seen the ovum in a considerably advanced state, in which also its relationship to the ovary could not be mistaken. In this instance the lower portion of the generative organ had dilated into a sort of capsule, within which the egg, Pl. II. fig. 6 *a* & Pl. III. fig. 4 *e*, was enveloped. The portion of the ovary, Pl. II. fig. 6 *c*, below it was short and thick, having the appearance of a pedicle, by which the egg was fixed to the side of the cell; above the capsule, the ovary, *c'*, was much thinner, contracting suddenly upwards. This would seem to demonstrate that the egg is developed in the interior of the ovary.

I have also seen what I take to be the ovum of *Paludicella*, but as it differs considerably from the egg of the other freshwater *Bryozoa*, we must not pronounce with certainty. This supposed egg was first observed in the cell of the dead polype; two or three occurred; they were attached to the upper portion of the interior of the cell. Afterwards one, Pl. IV. fig. 7 *e*, was found in connexion with the living animal, and in this case was fixed by a delicate membranous sac, *f*, to the side of the cell at the point of attachment of the filament coming from the upper end of the stomach, the base of the filament being apparently surrounded by the sac. This filament then, in *Paludicella*, is probably an ovary; and if so, the egg must pass in a very early stage from it into the membranous sac at its base, and there be matured. And, judging from analogy, the other filament is also probably connected with generation.

In *Plumatella* and *Fredericella* however there can be no doubt of the ovarian character of one of the filaments attached to the stomach; but the nature of the other two, Pl. III. figs. 4 *f* & 5 *h*, *h*, is not so easily determined. They certainly do not look altogether unlike muscular fibres; but from their attachments close to that of the ovary, and from their resemblance to it, they are most probably connected with the generative function. It may be that each filament is a separate ovary, or that one or two of them is the male organ. These polypes are most probably hermaphrodites—at least, in all the specimens of *Plumatella Allmani* that I have examined, there was scarcely a cell that did not contain one egg or more. It may therefore be presumed that each individual is provided with male and female organs. Dr. Farre discovered moving bodies in the visceral cavity of *Valkeria* and some other of the marine forms, and described them as re-

* I have also seen a similar nucleated cell in the enlarged filament from the lower end of the stomach of *Bowerbankia*.

sembling *Cercariae*. I have detected similar bodies in *Bowerbankia* with large rounded heads and long tails; they were very numerous, and moved rapidly about in the interior of the cell in the manner of tadpoles, that is, with a lateral undulating motion, and are assuredly *Spermatozoa*. A testis may then be expected to exist in the freshwater *Bryozoa* coextensively developed with the ovary, and from analogy to be associated with it. It is not unlikely therefore that these additional filaments from the stomach may be really the male organ.

Each polype does not appear to produce more than two or three eggs; in *Plumatella* frequently only one. In *P. Allmani* they, Pl. III. fig. 5 *f*, are considerably depressed, of an oval form, sometimes very long with the sides almost parallel; they are very large, being sometimes almost as wide as the diameter of the cell, within which they are placed lengthwise; the margins are reticulated, yellow, pellucid, thin, and sharp, forming a well-defined rim about the central portion, which is opaque and black; the covering is smooth, tough, and membranous. In *Fredericella* the egg is broader and more regularly oval, of a brownish colour with the margin narrow, plain and of a paler hue. The egg, Pl. IV. fig. 7 *e*, of *Paludicella*, if egg it be, differs considerably from the above. It is of an irregular oval shape, about half as wide as the cell, colourless and pellucid; the surface is marked with a few indistinct, irregular, nucleated cells; one larger and much more conspicuous than the rest, with a distinct round nucleus in the centre, is always to be seen on one side. The circumference of the egg exhibits a double margin indicating an enveloping shield.

The great size of the egg forbids the possibility of its escape without the destruction of the polype*. In *Plumatella*, the

* The polype of the marine species must also perish on the escape of the gemmule. On examining some specimens of *Bowerbankia* in August, almost every cell was found to contain a large, round, opaque, bright yellow corpuscle. These corpuscles were for the most part in the lower portion of the cells; some however were halfway up, and others not far from the top: those lowest down were the smallest, and as they approached the top they increased in size until their diameter was nearly equal to that of the cell. As long as the corpuscle remained near the lower extremity of the cell, the polype was alive and active; but was invariably dead when it had advanced far upwards. At first the corpuscle does not appear to have any envelope, but as it increases in size a distinct margin makes its appearance, which afterwards becoming wider and perfectly transparent, the corpuscle can be seen rotating within by the aid of the long cilia that clothe its surface. While watching one in this state under the microscope, I observed it gradually elongate itself and pass with a slow gliding motion to the top of the cell; then forcing its way through the previously closed orifice, and passing into the surrounding fluid, commenced to rotate with extraordinary velocity: in an instant after this its enveloping membrane was torn open and cast aside, and the little being, a broadly ovate gemmule, dashed at once beyond the field of view. It afterwards kept moving about in various

ova on maturity become attached to that side of the cell which is connected to the substance sustaining the polypidom. And here they remain fixed, indicating the track of the various branches of the Bryozoon long after its decay and disappearance in autumn. The free branches however must scatter their eggs. Most likely in *Fredericella*, too, they are dispersed, and borne away by the currents on the destruction of the polypidom, which is very freely branched; and in no instance have I seen its eggs left adhering to the surface of its attachment.

Having now gone through the details of the anatomy and development of the freshwater *Bryozoa* as far as I have been able to study them during a very short but laborious investigation of the subject, it is quite evident that these animals are as highly organized as the marine Ascidian polypes. *Plumatella* and *Fredericella* certainly show some interesting deviations from that type; but in *Paludicella* we perceive an almost complete resemblance to it; proving the close affinity that exists, and the propriety of uniting the whole into one group. The approximation of this genus to the marine forms is evinced not only by the muscular system, but likewise by the digestive apparatus; and by the bright, pellucid, horny character of the external polypidom. It is also equally evident that the organization of this group is very much above that of the typical *Radiata*. This Professor Allman has already clearly demonstrated; and yet perhaps we ought to hesitate before removing the *Bryozoa* into the subkingdom *Mollusca* as proposed by this naturalist.

The immediate relationship of these animals to the *Ascidie* is too obvious to be called in question,—a relationship which has long been acknowledged, though the homology of the parts does not appear to be correctly understood; at least it will bear another interpretation, which I am inclined to look upon as the true one. Dr. Farre observes in his paper, that “in *Tunicata* the tentacles are reduced to mere rudiments at the entrance of the respiratory sac, and the cilia are distributed over the surface of this cavity, which is in proportion magnified, and is analogous to the pharynx of *Ciliobrachiata*. The more immediate entrance to the alimentary canal, thence called mouth, being situated at the bottom of this sac, corresponds with the part that I have called cardia.”

This view of the relationship of the parts has with some modifications been generally followed by subsequent writers. In all the Ascidians however, there is a well-defined œsophagus,

directions and evinced great activity, cilia densely clothing it from end to end. The cell after the escape of the gemmule continued gaping; and the polype, which before was indistinctly visible, had now quite disappeared, nothing but slight traces of the retractor museles remaining.

which in *Clavelina* is frequently of great length. Why then should the entrance to it be considered to correspond to the cardia in *Bryozoa*? These as well as the *Ascidie* have a well-marked stomach with cardiac and pyloric orifices; in both, too, there is a distinct œsophagus; then should not the orifice leading to it be assumed to be the mouth, or analogous to the mouth in both? In the polype a series of respiratory tentacles, in the *Ascidie* the branchial sac, surrounds this mouth; should not these then be considered homologous? The affirmative of this would appear to be the natural inference in the first instance. But we are referred to the tentacular filaments at the entrance of the respiratory sac as the true representatives of the tentacles of the polype. With the view to ascertain how far this is correct, I examined with much care *Ascidia sordida* and *Molgula arenosa*, and found that these tentacular filaments are not anatomically connected with the branchial sac, but are developments from the tunic. The sac terminates a little way below these filaments, and they fringe the inner circumference of the belt of sphincter muscles which guard the respiratory orifice. These tentacular filaments, then, originating in the tunic, cannot possibly be the homologue of the tentacles of the polype, as these undoubtedly belong to the alimentary canal; but are in fact a new development in connexion with the sphincter of the tunic, and share its function. The tentacles then of the polype and the branchial sac of the Ascidian would appear to be homologous;—unless indeed the tentacles of the one have died out, and the branchial sac of the other is altogether a new development, which is not by any means likely.

In confirmation that the former is the fact, we have only to look at the growing bud of the polype, which so closely resembles an Ascidian, particularly when young, that it might at first sight be taken to be one. The tentacles at this time, all lying parallel to each other within the membranous sheath, have quite the appearance of a branchial sac; and when we take in connexion with it the alimentary canal, the resemblance is almost complete. Indeed, all that is wanting to turn the polype into an Ascidian, so far as the alimentary and respiratory organs are concerned, is the union of the tentacles by a vascular membrane. And we have already seen that such an union has commenced in *Fredericella*, *Plumatella* and *Aleyonella*. We have seen that in all these genera the tentacles are united at the base by a delicate membrane; and in the former this membrane is so extensive as to suggest the idea of a rudimentary form of the branchial sac of the *Tunicata*.

Taking this view of the homology of the parts, the longitudinal laminae in the interior of the branchial sac of the *Ascidie* will

represent the tentacles of the *Bryozoa*; and the membrane at the base of the tentacles being external corresponds exactly in position to the vascular membrane of the *Ascidia*, which is also external to the laminae. The position of the nervous ganglion in the two forms might at first sight appear to favour the contrary opinion; but on closer inquiry it is evident that the ganglion of the *Bryozoa* is not homologous with that of the *Ascidia*: in the former it is a cerebral ganglion resting on the œsophagus immediately behind the mouth; in the latter, if it has relationship to any of the nervous centres of the *Mollusca*, it is apparently analogous to the branchial ganglion of the *Lamellibranchiata*; but its position in the mantle is anomalous.

We thus see how very intimate is the connexion between the *Bryozoa* and the *Ascidia*; and as the latter are generally supposed to be as closely connected with the *Lamellibranchiata*, no great distance would appear to divide them from the former. They are not, however, so closely related as might be supposed. At first sight an Ascidian undoubtedly seems very closely to approximate to a bivalve shell; but this similarity on careful investigation would appear to be more that of analogy than homology—a mere resemblance rather than a true relationship. The branchial sac of the Ascidian is frequently assumed to be the same organ as the gill-plates of the *Lamellibranchiata* somewhat modified;—in function there is no difference; but anatomically they are distinct. The former is a development from the alimentary canal; the latter, according to Professor Owen, “are essentially internal folds of the pallial membrane.” The breathing organs then of these animals are not homologous. To turn therefore an Ascidian into a Lamellibranchiate mollusk, a new branchial organ must be developed. The vascular system, too, if not anatomically different in the Ascidian, is in a remarkable manner functionally so. In this the heart is at once systemic and pulmonic. And it is worthy of remark, that thus, on the first appearance of the vascular apparatus in this type of animals, it should shadow forth the peculiarities of both the molluscan and the piscine heart; and this, too, in connexion with a pharyngeal gill. The test or outer sac, and the inner sac or tunic of the *Tunicata* are not related to each other in the same manner as the shell and mantle of the mollusk. In this the shell is extra-vascular, and is secreted by the mantle; in the former the test is vascular, and its growth is therefore not dependent on that of the inner sac or tunic. The reproductive system of the *Lamellibranchiata* is likewise very different from that of the *Tunicata*. In these it is formed on the type of the *Radiata*; another and very striking proof of the relationship that exists between the former and the *Bryozoa*. These and other points of difference

led Professor Milne-Edwards, in his valuable memoir on the 'Ascidians Composées,' to propose the separation of the *Tunicata* from the *Mollusca*, and the formation of them into a distinct group to be placed between the bivalves and the polypes.

We then cannot find a passage from the *Bryozoa* through the *Ascidia* into the *Lamellibranchiata*. There are however two distinct branches of the Ascidian polypes,—one with the tentacles arranged in a circle about the mouth,—the other having them supported on two lateral oral arms. The former of these branches passes into the Ascidian,—the latter I shall endeavour to show is connected with the *Brachiopoda*.

This connexion is at once suggested by the resemblance that exists between the oral arms of *Phmatella* and *Alcyonella* and the characteristic brachial organs in the *Brachiopoda*, particularly of those in *Lingula*. In both the *Brachiopoda* and the *Bryozoa*, the arms rise from the sides of the mouth in the same manner, the bases of the arms being confluent; and the tentacles or cirrhi forming a continuous series. In both the arms are hollow, and the tentacles and cirrhi are tough and non-contractile; and in both they are prehensile organs after the same fashion. The digestive organs of both are very similar; and the whole of the *Brachiopoda* are fixed, and so are the *Bryozoa*, with but one exception.

But what is still more remarkable, the muscular systems of both are arranged much in the same manner, particularly as respects *Terebratula* and *Paludicella* with most of its marine congeners. In *Terebratula*, as the animal is fixed within the shell, of course there can be nothing resembling the polype retractors; but the shell muscles of *Terebratula* will be found to work exactly on the same principle as those provided to draw in the margins of the cell-orifice in *Paludicella* and *Bowerbankia*, and called by Dr. Farre opercular muscles.

There are four sets of muscles in connexion with the shell in *Terebratula chilensis* as dissected by Owen, two from each valve; and they all pass diagonally downwards, and with one exception go to be inserted in the pedicle; so that when they contract the valves will be closed. These muscles then have in fact their origin in the pedicle as stated by Owen, and acting from thence upon the moveable points of their insertions, operate precisely in the same way as the tube-retractors of the polypes last mentioned do on the lips of the orifice. The action is the same in both; and were the cell-walls of *Bowerbankia*, for instance, calcified and divided longitudinally into two portions or valves, they would be made to close just as the valves do in *Terebratula*. The set of muscles alluded to as not passing into the pedicle comes from the perforate valve, and inclining downwards is

attached by the other end to the base of the imperforate valve, binding the parts of the hinge-joint together—a substitute in fact for a ligament. In some species this set assumes in part the function of an adductor muscle.

We have then evidently some reason for supposing that the *Brachiopoda* as well as the *Ascidie* are related to the *Bryozoa*; and it is in this way that these latter are connected with the *Lamellibranchiata*. After a careful examination of the *Brachiopoda*, it is impossible to doubt the connexion that exists between the two great divisions of the testaceous *Acephala*. Indeed this is evident, whether we look to the digestive organs, the vascular system, or to the reproductive apparatus. It is in these animals, too, that the respiratory organ is first found in connexion with the mantle,—in *Terebratula* quite rudimentary, in *Lingula* to some extent specialized. On comparing *Anomia* with *Orbicula*, this relationship is best seen. In both the mantle is completely separated, and in both it is connected with the ovary; the large oral palpi of the one form the homologue of the branchial organs of the other; and we see this relationship in the deficiency of pedal organ in *Anomia*, and in the extensive union that still subsists between its breathing apparatus and the mantle: the perforation of the under-valve of both is also remarkable; but not more so than that the great muscle of both should be divided,—part forming the adductor, part the adhesive disc.

We have now endeavoured to trace the affinities of both branches of *Bryozoa*; one appears to pass at once into the *Ascidie*, which, how closely soever related analogically to the *Lamellibranchiata*, are nevertheless removed far from them by the nature of their vascular, respiratory and reproductive systems. In the *Mollusca* the heart is always systemic, and the gill is universally an appendage to the mantle. In the *Ascidie* the heart is as much pulmonic as systemic, and the breathing apparatus is a development from the alimentary canal—is in fact pharyngeal. In these respects the Ascidian deviates from the Molluscan type and approximates to that of the lower *Vertebrata*,—the fishes, in which the heart is pulmonic and the breathing organ pharyngeal. The reality of this relationship is revealed by the anatomy of the Lancelet so ably described by Professor John Goodsir, who has pointed out the resemblance of its respiratory system to that of the *Tunicata*. Indeed the branchial sac and vascular apparatus of this curious fish almost completely resemble those organs in the Ascidian.

The other branch of the *Bryozoa*, comprising those with oral arms, passes into the *Brachiopoda*; or at least this is rendered more than probable by the resemblance of the brachial organs of the latter to the arms of the former, and by the similarity of the

muscular arrangement. Thus the *Bryozoa* become related to the *Lamellibranchiata*, which are apparently closely related to the *Brachiopoda*. We may conclude then, if we have arrived at a right understanding of the affinities of these animals, that both the *Mollusca* and *Vertebrata* are connected with the *Bryozoa*. It would be well therefore to pause before including the *Bryozoa* in the *Mollusca*, and consider the propriety of uniting the former with the *Tunicata*, and perhaps with some of the higher forms of *Rotifera*, into a group to be placed at the head of the *Radiata*.

Descriptions of new Species.

Plumatella punctata. Pl. V. figs. 6 & 7, and Pl. III. fig. 1.

Polypidom adhering throughout, coriaceous, pellucid, of a pale watery green colour, irregularly but not much branched, seldom extending more than half an inch; branches composed of a series of large, conical cells tapering upwards towards the aperture, sometimes considerably and rather suddenly dilated at the base; resembling in form some of the *Ascidians*; the upper portion of the cell almost colourless and freckled with minute opaque white spots, most crowded towards the orifice. Tentacles white, not more than sixty in number; membrane at their origin rather wide, scalloped, the points of the scallop extending for some distance up the back of the tentacles in the form of broadish laminæ arched outwards. Œsophagus and stomach appearing through the transparent walls of the cell of a pale yellow colour. Egg perfectly black, large, broad and oval.

Upwards of a dozen specimens of this fine species occurred in Bromley Lough, adhering to the underside of stones; it was likewise taken in Crag Lough. None of the individuals much exceeded in size that represented in the figure, nor did they vary in any remarkable manner either in form or colour. It is not, however, without hesitation that I have ventured to characterize this as a new species, as Professor Allman informs me that it may perhaps turn out to be *P. repens*; but that form is stated to be large and of luxuriant growth, and to have the polypidom tubular with the cells dilated at the orifice—characters which do not at all agree with *P. punctata*. Indeed it can scarcely be considered a true *Plumatella*.

P. Allmani. Pl. V. figs. 3 & 4, and Pl. III. figs. 2 & 3.

Polypidom attached to the underside of stones, adhering throughout, membranous, opaque, yellowish brown, slightly branched, extending in patches sometimes three or four inches wide, the patches being made up of several polypidoms; the branches composed apparently of a series of tubular cells,

tapering to their origin, and attached for more than half their length; the enlarged extremity, being free and bending upwards, inclines a little to one side, and is occasionally bifid, forming two cells; an obtuse ridge or keel extends the entire length of the cell, increasing imperceptibly in thickness upwards; orifice somewhat constricted, the walls immediately below being pellucid, and suddenly dilating become abruptly opaque and thickly covered for some distance downwards with agglutinated sand. Tentacles forty-two in number, slightly tinged with yellow, the colour best seen when they are formed into a compact bundle; membrane at their base distinct, scalloped, the points being prolonged a little up the tentacles. Egg black, long, oval; sides nearly parallel; margins pellucid, yellow, sharp, broad and reticulated.

This species was procured rather abundantly in Bromley Lough, and does not appear to vary much. At first sight large patches of it have the appearance of being formed of a single polypidom; but on close examination are found to be composed of many, and rarely to number more than six or eight cells in each. The commencement of each polypidom has the black envelope of the originating egg adherent.

Two or three specimens of a more branched form of carinated *Plumatella* were taken in Bromley Lough, which may probably prove a distinct species; more individuals however are necessary before it can be characterized.

Paludicella procumbens. Pl. V. figs. 1 & 2, and Pl. IV.

Polypidom membranous, subhorny, pellucid, smooth and glossy, of a brownish horn-colour, much and irregularly branched, forming large patches on the underside of stones, for the most part adhering, with rather numerous, short, free, almost simple branches; the branches composed of a single series of narrow cells arranged longitudinally, contracting towards the base and widening upwards; aperture lateral, near to the upper extremity of the cell, forming a rather long and somewhat constricted tube inclining upwards; margin entire, surmounted by a widish, delicate, hyaline, membranous cup. Tentacles sixteen in number, arranged in a complete circle, and when spread out forming a very exact inverted cone.

This, the second species of the genus, resembles very closely *P. articulata* of Allman, but that form appears to have about twenty-six tentacles, and is likewise more densely and luxuriantly branched; the cells, too, are larger and of a different colour.

The *P. procumbens* occurred in both Bromley and Crag Loughs, but most abundantly in the latter, where it spreads over the under surface of stones in patches of 5 or 6 inches diamêter.

EXPLANATION OF PLATES II., III., IV. AND V.

PLATE II.

- Fig. 1.* Upper portion of *Fredericella sultana* seen as a transparent object very much magnified: *a*, tentacular disc; *b*, tentacles; *c'*, membrane at base of ditto; *c*, flounced margin of ditto; *d*, mouth; *e*, oral valve; *f*, œsophagus; *g*, projecting lips of cardiac orifice; *h*, stomach; *i*, intestine; *j*, anus; *k*, nervous ganglion giving off nerves; *l*, tentacular sheath doubled upon itself; *m*, strong radiating muscles for preventing complete inversion of ditto; *n*, delicate radiating muscles in connexion with the orifice of cell; *o*, outer wall of cell; *p*, inner wall or tunic; *q*, inverted lips of orifice; *r*, the point where the same unite to the tentacular sheath, immediately below which is the sphincter for closing the cell.
- Fig. 2.* Retracted polype of *Plumatella Allmani* seen by transmitted light and much magnified: *a*, bundle of tentacles enveloped in membranous sheath; *a'*, tentacular disc; *b*, œsophagus; *c*, projecting lips of cardiac opening; *d*, stomach; *e*, intestine; *f*, anus; *g g*, muscles for retracting the polype; *h*, large radiating muscles for preventing complete inversion of tentacular sheath; *i*, delicate radiating muscles in connexion with the orifice of cell; *j*, outer wall of cell; *k*, inner membrane or tunic; *l*, inverted margin or lips of orifice; *m*, tentacular sheath; *n*, sphincter contraction of ditto; *o*, bud in second stage of development; *p*, tentacular sheath of ditto forming; *q*, retractor muscles in an incipient state.
- Fig. 3.* Upper portion of the cell of *Plumatella Allmani* much enlarged: *a*, bud in first stage of development attached to the inner surface of lining membrane of cell.
- Fig. 4.* Cell with exerted polype of *Fredericella sultana* much enlarged and seen as a transparent object: *a*, tentacular disc; *b*, oral valve; *c*, œsophagus; *d*, stomach; *e*, intestine; *f*, the two bundles of polype retractors; *g*, two fibres of same for rotating tentacular disc; *h*, egg in connexion with ovary, attaching it to lower end of stomach and wall of cell; *h'*, appendage to the lower end of stomach, probably generative; *i i*, outer wall of cell; *j j*, lining membrane or tunic; *k*, bud in third stage of development; *l*, tentacles of ditto as they at first appear; *m*, stomach of do.; *n*, retractor muscles of ditto; *o*, nucleated cell—the incipient egg in connexion with the ovary.
- Fig. 5.* Bud in third stage of development more highly magnified: *a*, tentacular disc; *b*, œsophagus; *c*, stomach; *d*, intestine; *e*, incipient egg in enlarged portion of ovary; *f*, wall of cell.
- Fig. 6.* Egg and ovary much enlarged of *Fredericella sultana*: *a*, egg imbedded in ovary; *b*, wall of cell to which lower end, *c*, of ovary is attached; *c'*, upper portion of ovary leading to stomach.

PLATE III.

- Fig. 1.* Side view of exerted tentacular apparatus much enlarged of *Plumatella punctata*: *a*, œsophagus; *b*, oral valve; *c*, tentacular or oral arms; *d*, tentacles; *e*, membrane at base of ditto; *f*, laminae at back of ditto.
- Fig. 2.* Enlarged view of under side of tentacular apparatus of *Plumatella Allmani*: *a*, margin of orifice of cell; *b*, intestine; *c*, œsophagus; *d*, oral valve; *e e*, oral arms; *f*, membrane at base of tentacles.
- Fig. 3.* Enlarged view of the upper side of tentacular apparatus of *Pluma-*

tella *Allmani*: *a*, mouth; *b*, oral valve; *c c*, oral arms; *d*, membrane at base of tentacles.

Fig. 4. Much-enlarged view of the reproductive organs of *Fredericella sul-tana*: *a a*, outer wall of cell; *b b*, lining membrane or tunic; *c*, lower portion of stomach; *d d*, ovary; *e*, egg imbedded in same; *f*, two filaments attached to the lower end of stomach, probably connected with the reproductive system; *g*, retractor muscles.

Fig. 5. Enlarged view of a cell of *Plumatella Allmani* exhibiting reproductive organs: *a*, base of oral arms; *b*, œsophagus; *c*, stomach; *d*, intestine; *e e'*, ovary; *f*, egg nearly mature, still attached to ditto; *g*, an egg just forming likewise attached to ovary; *h h*, two filaments attached to the stomach, probably connected with the reproductive system; *i i*, the two bundles of retractor muscles; *j*, outer wall of cell; *k*, lining membrane or tunic.

PLATE IV.

Fig. 1. Enlarged view of a cell of *Paludicella procumbens* seen as a transparent object, the polype being exerted: *a a*, outer wall of cell; *b b b*, lining membrane or tunic; *c*, tubular orifice; *d*, membranous cup surmounting ditto; *e*, tentacular disc; *f*, tentacles; *g*, pharyngeal swelling; *h*, œsophagus; *i*, stomach; *j*, intestine; *k*, enlargement at commencement of ditto; *l*, anus; *m*, supposed ovary; *n*, filament attached to the lower extremity of stomach, probably connected with the reproductive system; *o*, polype retractor muscles; *p p*, inferior tube-retractors; *q*, two fibres of superior tube-retractors; *r r*, muscles to prevent the complete inversion of tentacular sheath; *s*, tentacular sheath doubled upon itself; *t*, parietal muscles; *u*, end-walls of two cells abutting against each other.

Fig. 2. Enlarged view of a single cell of *P. procumbens* with polype retracted: *a*, outer wall of cell; *b*, lining membrane of ditto; *c*, retracted tubular orifice; *d*, tentacles; *d' d'*, tentacular sheath; *e*, œsophagus; *f*, cardiac orifice; *g*, stomach; *h*, intestine; *i*, enlarged portion of ditto; *j*, supposed ovary doubled upon itself; *k*, filament attached to lower end of stomach, probably connected with reproductive system; *l l*, polype retractor muscles; *m m*, inferior tube-retractors; *n n*, superior tube-retractors; *o*, sphincter muscles for closing orifice; *p*, do. do.; *q q*, muscles to prevent complete inversion of tentacular sheath; *r*, end-wall of cell formed by the tunic exhibiting enlargement in the centre.

Fig. 3. End of retracted tube of *P. procumbens* exhibiting the manner in which it folds in.

Fig. 4. Termination of a branch of *P. procumbens* comprising two cells in different stages of development: *a*, outer wall of cell in fourth stage of development; *b*, lining membrane of ditto; *b'*, blind termination of do. do.; *c*, place of future orifice; *d*, tentacles of polype in state of development; *e*, œsophagus; *f*, stomach; *g*, intestine; *h*, lower reproductive organ; *i*, tentacular sheath; *j*, polype retractor muscles; *k*, tube-retractors; *l*, new cell in first or earliest stage of development, exhibiting lining membrane and external wall; *m*, nucleated cells in lining membrane.

Fig. 5. Two terminal cells of *P. procumbens* containing buds in different stages of development: *a*, tentacles of bud far advanced or in fifth stage of development; *a'*, tentacular sheath; *b*, œsophagus; *c*, stomach; *d*, intestine; *e*, anus; *f*, lower reproductive organ; *g*, polype-retractors; *h*, parietal muscles; *i*, tube-retractors; *j*, tube

just forming; *k*, outer wall of last-formed cell exhibiting bud in second stage of development; *l*, lining membrane of ditto; *m*, bud as it appears at first.

Fig. 6. Terminal cell exhibiting bud in third stage of development: *a*, outer wall of cell; *b*, lining membrane; *c*, bud; *d*, tentacular sheath; *e*, polype-retractors just making their appearance.

Fig. 7. Enlarged view of a portion of the polype of *P. procumbens* exhibiting reproductive system: *a*, œsophagus; *b*, stomach; *c*, intestine; *d*, supposed ovary with the egg, *e*, attached; *f*, membranous envelope of the egg; *g*, lower filament supposed to be connected with the reproductive system.

PLATE V.

Fig. 1. Polypidom of *Paludicella procumbens* slightly enlarged.

Fig. 2. A portion of ditto much enlarged, exhibiting two or three series of cells.

Fig. 3. A patch of *Plumatella Allmani* magnified two times, comprising several polypidoms.

Fig. 4. Two or three polypidoms of ditto more highly magnified, exhibiting the polypes exerted and the envelope of the originating egg *a a*.

Fig. 5. A single cell of same still more highly magnified: *a*, keel or ridge on the upper surface of cell.

Fig. 6. *Plumatella punctata* five or six times magnified, exhibiting polypes exerted: *a*, envelope of originating egg.

Fig. 7. Three cells of ditto more highly magnified and more produced than usual, with the polypes exerted.

XIX.—Contributions to the Botany of South America.

By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from p. 35.]

BROWALLIA.

THE affinity of *Browallia* with *Salpiglossis* is sufficiently evident, but in many respects it approaches very closely to *Petunia*. In the tabular arrangement suggested on a former occasion (*huj. op.* iii. p. 172), *Browallia* was associated with the *Salpiglossideæ*, on account of the apparent æstivation of its corolla, combined with its other characters. I regret very much, that since my attention has been directed to this investigation, I have had no opportunity of examining a flower in its living state, as by this means only could its precise mode of præfloration be ascertained: it is certainly not imbricative as in *Franciscea*, but is either replicative or reciprocative, as in *Petunia* or *Salpiglossis*; judging from its appearance after being pressed and dried, it seems to be rather that of the last-named genus. The following generic features have been derived wholly from an examination of dried specimens:—

BROWALLIA, Linn. (char. reform.).—*Calyx* tubulosus, subcylindricus, 10-nervis, 5-dentatus, dentibus inæqualibus, 3-nerviis,

augescens et persistens. *Corolla* hypocraterinomorpha, tubo angusto, cylindrico, calyce 2–3-plo longiore, superne et antice ventricosus, fauce in oram elevatam constricto, limbo obliquo, plano, breviter 5-partito, lobis rotundatis, emarginatis, inæqualibus, rarius oblongis, acutis, antico paulo majore, æstivatione reciprocativa? *Stamina* 4, didynama, inclusa; *filamenta* brevina, 2 antica inferiora, sublongiora, hemicyclice curvata, imo dilatata, apice expansa, inflexa et pilosa; *antheræ* sagittato-bilobæ, inversæ, lobis ovatis, rima marginali dehiscentibus, superiorum lobo altero minimo casso. *Ovarium* obovatum, apice pilosum, inferne glaberrimum, sæpe stipitatum, rarius omnino glabrum, 2-loculare, placentis carnosus prominulis dissepimento utrinque adnatis, multi-ovulatis. *Stylus* simplex, apice incrassatus, inflexus, transversim rugulosus. *Stigma* dilatato-bilobum, lobis emarginatis altero majore, intus septis cruciatim in locellis 4 stigmatosis divisum. *Capsula* membranacea, calyce persistente tecta, 2-locularis, 2-valvis, valvis bifidis, dissepimento tenuissimo demum libero parallelis. *Semina* plurima, minuta, obovata, lateribus angulata, dorso convexa, ventre concava et infra medium hilo notata; testa reticulato-foveolata. *Embryo* in axi albuminis carnosus homotrope subincurvus, cotyledonibus ovatis, compressis, radícula tereti infera 3-plo brevioribus et 2-plo latoribus.—Herbæ *Americæ intertropicæ indigenæ, plus minusve viscido-pubescentes*. Folia *alterna, integra*. Flores *ad axillas foliorum superiorum solitarii, cum petiolis sublaterilibus, interdum foliorum minutione in cymas irregulares terminalibus dispositi*; pedunculo *florifero brevi, interdum fructifero mox elongato*; corolla *violacea, cærulescens, aut albescens*.

In addition to the species enumerated by Mr. Benthams in DC. Prodr. x. 197 et 590, and the *B. speciosa* of Sir Wm. Hooker, Bot. Mag. tab. 4339, I have now to mention two others yet undescribed:—

Browallia tenella (n. sp.);—herbacea, humilis, parce puberula, foliis membranaceis, lanceolatis, vel ellipticis, in petiolum elongatum cuneatis; floribus paucis, solitariis, axillaribus, calycis membranacei dentibus lanceolatis, obtusis, inæqualibus; corollæ tubo gracili, calyce 4-plo longiore, limbo brevi, plano, sinuato-pentangulato, lobis brevissimis, emarginatis, rotundatis, antico majori; ovario apice piloso.—Rio de Janeiro.

This species, which I found growing at Pertinuinguy in 1830, has very much the habit of *B. demissa*, but is readily distinguished by the much greater length of the petiole, fewer flowers, a more slender corolla with a much narrower border, a more membranaceous calyx with less prominent nervures, and by the simple hairs and almost obsolete pubescence of the whole plant.

It is remarkable as being the first instance of any species growing so far to the southward of the equator and upon the eastern side of the continent. It is scarcely more than 6 or 8 inches high, with a very slender and almost glabrous stem, but little branched; its leaves are $1\frac{1}{4}$ inch long, $\frac{3}{4}$ inch wide, upon a very slender filiform petiole of $\frac{3}{4}$ inch; the peduncle of the flower is barely 2 lines long, growing to a length of 7 lines; the tube of the calyx is 2 lines long, with teeth scarcely a line in length; it is cylindrical, $\frac{3}{4}$ line in diameter, growing to a length of 4 lines in fruit and a diameter of 2 lines, wholly enclosing the capsule; the tube of the corolla is very slender, 8 lines in length, of a greenish lurid white; the border is 4 lines in diameter, at first of a pale bluish colour, afterwards becoming of a violet hue. The internal structure of the flower, capsule and seeds entirely agrees with that of the typical species*.

Browallia nervosa, n. sp. ;—foliis ellipticis, acutis, in petiolum longiusculum canaliculatum attenuatis, ciliatis, utrinque sparsim scabrido-pilosulis, penninerviis, nervis subtus prominulis, floriferis fere bracteiformibus; floribus axillaribus laxe subracemosis; calyce parvulo, angustato, cylindrico, dentibus acutis, erectis, ciliatis, nervis 10 violaceis picto, glabro; corolla hypocraterimorpha, tubo angusto, calyce 2-plo longiore, limbo lato, plano, violaceo, lobis brevibus emarginatis; ovario obovato, apice piloso.—Ecuador, v. s. in herb. Hooker. (Villa Sasaranga, prope Loxam). Seemann, no. 740.

This plant is intermediate with *B. peduncularis* and *B. grandiflora*, from both of which it is evidently distinguished by the remarkably contracted form of its calyx and peduncle. It differs also from *B. demissa* by its leaves being more acute at their base, with a comparatively longer and more winged petiole, and by its more racemose flowers. The leaves are $1\frac{1}{4}$ inch long, 8 lines broad, on a petiole half an inch in length, with the coriaceous texture and general appearance of those of *B. peduncularis*. The calyx, having five short pointed erect teeth, is at first extremely narrow, 4 lines long, $\frac{3}{4}$ line in diameter, swelling to a much larger size in fruit; the tube of the corolla is 8 lines long, $\frac{1}{2}$ line in diameter, slightly swollen below the very narrow mouth; the border is large in proportion, quite plane and rotate, 9 lines in diameter, and of a purple colour; the capsule, 3 or 4 lines long, is hairy at the summit of its bifid valves.

It appears desirable to divide the species of *Browallia* into two sections; the first including those whose corolla presents a plane border, with short emarginate lobes, and an ovarium with its

* A figure of this species with generic details will be shown in plate 54 of the 'Illustr. South Amer. Plants.'

upper moiety densely covered with long white hairs, which are even persistent on the capsule; the second will comprise such as do not possess these characters, and is confined at present to a single species: thus—

§ 1. *EUBROWALLIA*. Corollæ limbus planus, rotatus, lobis brevibus, emarginatis; ovarium cuneatum, apice obtusum, et dense pilosum.

1. *Browallia demissa*, Linn., DC. Prodr. x. 197.
2. ——— *viscosa*, H. B. K. ii. 373.
3. ——— *tenella*, n. sp. supra descript.
4. ——— *nervosa*, n. sp. ibid.
5. ——— *peduncularis*, Bth., DC. Prodr. x. 197.
6. ——— *grandiflora*, Grah. ibid.
7. ——— *abbreviata*, Bth. ibid.

§ 2. *LEIOGYNE*. Corollæ limbus profunde incisus, laciniis oblongis, acuminatis, 3-nerviis; ovarium subglobosum, sessile, omnino glaberrimum.

8. *Browallia speciosa*, Hook. Bot. Mag. tab. 4339. The much larger flowers of this species, its more acutely-lobed and deeper-cleft border, and constantly smooth ovary, are characters of hardly sufficient importance to constitute a generic difference; but at all events, with such marked distinctions, *Leiogyne* will form a good subgenus.

From the above enumeration *B. Jamesoni* has been excluded, because it differs in its characters, in the number of divisions of its calyx, in the shape of its corolla, the form and position of its stamens, and the structure of its stigma.

STREPTOSOLEN.

I have already alluded to the propriety of excluding from *Browallia* the species described under the name of *B. Jamesoni*, as it possesses many essential characters at variance with that genus. All the species of *Browallia* are herbaceous, while the plant above mentioned is suffruticose, forming a branching shrub 4 or 6 feet high, with very rugous, coriaceous and scabrid leaves; the inflorescence is also more corymbose, and the structure of the flower differs from that of *Browallia* in the following particulars. The calycine tube is crowned with four, rarely with five teeth; the corolla is not hypocrateriform, and its tube, instead of being slender and cylindrical, swells into a funnel-shape, immediately as it emerges from the calyx, and the contracted basal portion soon twists half a revolution, so that the border becomes actually resupinate; owing to the want of the contraction in the throat, the border does not assume the figure of a rotate 5-lobed

plane, but enlarges more in a campanular form with five short rounded lobes, the front lobe being broadest; it is however often 4-lobed by the confluence of the two upper smaller segments; the two lower stamens are not short, dilated, hemicyclical, and fixed in a ventricose swelling below the throat, but are here straight, slender and filiform, originating in the contracted base of the funnel-shaped tube and opposite the broader lobe of the border; the two upper filaments are also straight and nearly erect, although they are fixed in the mouth of the campanulate border, with one of the lobes of each anther almost abortive or dwarfish, as in *Browallia*; all the filaments are terete, not greatly dilated, and although at first hairy, they become at last quite glabrous. The style resembles that of *Browallia* in being swollen at its summit, where it is hollow and corrugated into numerous transverse folds; but the stigma is of an essentially different form, being suddenly expanded into two broad, compressed, auriculate, equal lobes, at first connivent, afterwards ringent, with a large opening in the sinus into the tubular summit of the style (and which in the living state is probably filled with mucous matter), thus approaching more to the form of the stigma of *Petunia*. The whole plant possesses much the habit of *Stemodia suffruticosa*, with which genus and with *Pterostigma* there exists some analogy in the form of the stamens and stigma. It will however constitute a genus belonging to the tribe *Petunieæ*, connecting this group still more closely with the *Salpiglossideæ* by *Browallia*. The name now proposed for this genus is derived from στρεπτός, *tortus*, σωλήν, *tubus*, because of the torsion of the lower portion of the tube of the corolla.

STREPTOSOLEN (gen. nov.).—*Calyx* tubulosus, 4-5-nervis, reticulatus, 4-5-dentatus, dentibus inæqualibus, persistens. *Corolla* infundibuliformi-tubulosa, subcurvula, limbo campanulato, subobliquo, brevissime 5-lobo, lobis apiculatis aut emarginatis, antico paulo latiore, tubi torsione mox resupinato, æstivatione replicativa. *Stamina* 4, didynama, inclusa, valde inæqualia, 2 inferiora (in alabastri antica) imo tubi orta, 2 superiora brevissima fauce inserta; *filamenta* teretia, recta, pilosa, mox glabra; *antheræ* 2-lobæ, subdeclinatæ, lobis ovatis, imo late divaricatis, margine dehiscentibus, singulo receptaculo pollinifero globoso intus instructo, superiorum lobo altero minimo casso. *Ovarium* ovatum, disco glanduloso stipitato imo cinctum, apice parce pilosum, demum glabrum, 2-loculare, placentis carnosissimis dissepimento adnatis, multiovulatis. *Stylus* filiformis, apice incrassatus, subincurvus, tubulosus, et transverse rugoso-crenulatus. *Stigma* valde dilatatum, imo late cordatum, 2-labiatum, lobis æqualibus obtusis conniventibus,

mox hiantibus, in sinu cavernosum. *Capsula* ovata, coriacea, calyce tecta, 2-locularis, 2-valvis, valvis 2-fidis, dissepimento libero parallelis. *Semina* plurima *Browalliae*.—Suffrutices *Nova-Granadenses et Ecuadorenses strigoso-hispidulae*. Folia ovata, coriacea, rugosa, aspera, petiolata, florifera ad bracteas redacta. Flores pedunculati, terminales, conferti, subcorymbosi. Corolla aurantiaca, extus valde pubescens.

1. *Streptosolen Jamesoni*. *Browallia Jamesoni*, Benth., DC. *Prodr.* x. 197;—fusco- et scabrido-hispidula, foliis ovatis, utrinque acutis, subcoriaceis, bullato-rugosis, subtus nervis valde prominulis, utrinque scabridis, longiuscule petiolatis, corymbo ampliore, calycis dentibus 4 subæqualibus, acutis, erectis, fusco-viridibus, tubo cylindrico, angustato, medio contracto, concolori: corollæ aurantiacæ tubo infundibuliformi ampliore extus molliter tomentoso, limbi campanulati lobis fere æqualibus, brevissimis, mucronulatis.—Ecuador, *v. s. in herb. Hook.* Loxa, *Hartweg*, no. 818. Sasaranga, prope Loxam, *Seemann*, no. 872.

I have already described in the foregoing page the peculiar habit of this species; the leaves are $1\frac{1}{4}$ inch long, 8 lines broad, on a narrow channeled petiole of 4 lines; above they are deeply furrowed at the nervures with prominent reticulate veins, hispidly pubescent below, scabrido-hispid above, of a very dark green colour, opaque and brittle when dried; the peduncles are 4 lines long; the calyx of equal length is $1\frac{1}{2}$ line in diameter, somewhat contracted in the middle, with almost lanceolate acute erect teeth; the corolla is 1 inch in length, the tube at base only a line in diameter, swelling to a diameter of 4 lines at the mouth, the border being about 8 lines in diameter; externally it is softly pubescent and almost smooth within. The lower pair of stamens have their origin somewhat fornicated, about 2 lines above the base of the tube, opposite the reflexed broader lobe of the border, are about 6 lines in length, quite smooth at base, minutely pubescent above; the upper shorter pair are inserted at 7 lines from the base and below the mouth of the tube, which is here slightly pubescent; they are all stiff and rigid, and want that peculiar arching expansion with long glandular hairs that forms so peculiar a character in *Browallia*. The style is about 7 lines in length, with a broadly expanded stigma, which is quite bilabiate and of a distinctly different form from that of the very remarkable stigma of *Browallia*. The pedicel and calyx do not sensibly enlarge in size; the capsule, which is wholly inclosed within the calyx, is quite smooth, but in other respects like that of *Browallia* and *Petunia**.

* This species will be figured in plate 55 of the 'Ill. South Amer. Plants.' *Ann. & Mag. N. Hist.* Ser. 2. Vol. v.

2. *Streptosolen Benthami* (an nov. sp. vel præcedentis var. ?) ;—ramulis griseo-hirsutulis ; foliis ovatis, minus rugosis, læte viridibus, nervis supra impressis, utrinque pilosulis, supra vix scabriusculis, breviter petiolatis ; floribus subcymosis, pedicellis calyce vix longioribus ; calyce subinflato, late tubuloso, ore valde obliquo, tubo pallide viridi, nervis fuscis lineato, dentibus 5, inæqualibus, ovatis, obtusis, cærulescentibus ; corollæ limbi lobis brevibus, emarginatis, lobo antico (in alabastro postico) multo majori, subreflexo.—Nova Granada, v. s. in herb. Hook. (inter Mivir et Naranjas, altit. 7000 ped., Jameson).

I have seen only a single and very meagre specimen of this "small shrub," which has few flowers: the leaves are of the same shape but somewhat smaller than in the foregoing species, much smoother and of a lighter colour ; the flower is about the size of that of *S. Jamesoni* ; the calyx is however larger, wider, with much broader and more obtuse segments ; it increases somewhat in fruit to a length of 6 lines and a diameter of nearly 3 lines, and conceals the capsule, which is about 3 lines long ; it has four thick coriaceous valves, is seated upon its stipitate support, and encircled at base by the induvial remains of the corolla.

XX.—*Notes on Montacuta ferruginosa.* By JOSHUA ALDER.

[With a Plate.]

THE interesting little bivalve *Montacuta ferruginosa*, though pretty generally diffused round the British coasts, has seldom been observed in a living state, and no account of the animal has been published, if we except the very imperfect one furnished by myself to Professor E. Forbes for the 'History of British Mollusca.' This, though correct as far as it goes, is by no means a complete description, having been taken under very unfavourable circumstances. I was glad, therefore, to meet with another living example of this species, which seemed less shy in displaying itself than the former one. It was taken from the stomach of a haddock,—a very unpromising locality certainly for meeting with anything in a living state,—but the little creature on being placed in sea-water appeared quite lively, and not visibly the worse for the uncomfortable quarters from which it had been extracted. In a short time it protruded the mantle beyond the shell, extended its large foot, and began to crawl about. The mantle of this species is curious and interesting from its showing a new modification of that part, intermediate between the plain anterior siphonal fold of *Kellia rubra* and the more elaborate form of mantle in *Lepton squamosum*, and thus supplying the desired link to

connect two genera, which had previously been placed in the same family from the characters of the shell, but whose animals, though agreeing in habits, presented a marked difference in their general appearance. The anterior part of the mantle in this species is ample and produced considerably beyond the shell, forming a kind of frill, which becomes gradually smaller and more even as it passes along the base of the shell. The exterior circumference of the mantle, lining the shell, is fringed with very delicate filaments, rather short and blunt, which extend completely round the margin of the valves, with the exception of a small space at the umbones. In these two particulars this species reminds us forcibly of the peculiar characters of *Lepton squamosum*, though they are displayed in a much less degree; and we may also recognise in them a resemblance to the anterior undulated portion of the cloak in the curious genus *Galeomma*, which, though distinctly observable in spirit specimens, I do not recollect to have seen well represented in any published figure. Thus then we trace a beautiful gradation of form in nearly all the genera of this family (*Kelliadae*), the distinguishing character of whose animals is to be found in the large development of the mantle, especially in its anterior portion. From the largely developed cloak in *Galeomma Turtoni* (if I am right in its character, for I have not seen it alive), we pass to the still more developed and undulated mantle of *Lepton squamosum*: in *Montacuta ferruginosa* the enlargement is chiefly confined to the anterior portion, which is undulated like the latter; in *Kellia rubra* the front of the cloak is still largely extended, but the margins are even and folded into a tubular form; while this part becomes an ample closed siphon in *Kellia suborbicularis*. Taking these characters into consideration, the idea suggested itself, that these genera might possibly agree in receiving the branchial currents anteriorly, as has been observed in the genus *Kellia*. For the purpose of ascertaining this point, I placed my specimen of *Montacuta ferruginosa* several times under the microscope, but without being able to make out anything satisfactory. I have however since ascertained that in *Montacuta bidentata*, a living specimen of which I fortunately procured, the principal ingress current is decidedly anterior, though the water is admitted occasionally through the whole length of the open mantle; the exit, which was less distinctly seen, being by the posterior aperture. In this species a short fringe surrounds the margin of the shell, but during the time I was able to keep it alive, no extension of the mantle was observed in front; though from the capricious manner in which these little animals display themselves, it would be premature to decide upon the absence of this character from a single observation. I had, on a previous occasion, had this species alive without seeing the fringe.

But to return to *Montacuta ferruginosa*. The mantle, which is open throughout the entire front and base of the shell, is closed posteriorly, forming a small excretory orifice, not produced into a siphon. The foot, as might be concluded from the much-elongated anterior portion of the shell, is very large and muscular; there is a slight angle about half-way down in front, beyond which it is rather narrower and tapers to a blunt point: the base is slightly undulating and grooved through its entire length, though it does not appear to spread out into a flat disc like that of *Lepton squamosum*: the hinder portion is abruptly truncated.

After having kept my specimen for some days in sea-water, I found one morning that the bottom of the glass was covered with a minute white dust, which I immediately concluded would be the spawn, and on placing a small portion under the microscope I found that such was the case. I consequently had it removed into a separate glass with a fresh supply of water, in order to observe its development. Though nearly round at first, the ova soon assumed a subtriangular shape, and about the third day, strong cilia were observed on one of the sides, and they began to rotate very quickly. One after another assumed the rotatory state, till nearly the whole were in motion. After rotating for about a day, they apparently burst the envelope, and swam freely about in the water in all directions, by means of their vibratile cilia, and at the same time assumed more or less of a bell-shape; a slender style or thread projecting from the centre of the ciliated base. This organ, which has been observed in the embryos of other species, has been described as a kind of byssus, by which the little creature can fix itself securely to other bodies. This, however, I did not observe to be the case in the present instance. It soon appeared to be absorbed; the animal became gradually elongated, and the cilia were withdrawn into the shell, which then began to appear, but at what time it was actually formed I could not make out, as, from its extreme transparency and similarity of colour to the rest of the animal, it was very difficult of detection. The cilia could be seen vibrating within the shell for some time after the animal became quiescent; a few isolated cilia at one of the extremities, not observed before, being the only ones that remained to perform their functions externally. These produced a partial current without propelling the animal through the water, as at this stage it gave up its natatory habits and took to a quiet life. The internal portion, the parts of which could not be very distinctly made out, appeared to be undergoing a process of development. The mass was continually changing its form, the separate parts being extended alternately in different directions, and a portion, probably the incipient foot, was occasionally pushed beyond the margin of the shell. At this point

of development further observations were unfortunately arrested by the death of the whole colony, in consequence of the water becoming impure, and my situation at a distance from the sea preventing my getting an immediate fresh supply. The whole period that I had kept them was not above five or six days, so that their development had been pretty rapid. After the death of the animals the shells remained at the bottom of the glass. They were of an elliptical form, straight at the upper margin, where they were attached, though the hinge did not appear to be yet formed: the whole, excepting in the elongated form, had very little resemblance to the adult shell.

The process which this embryo undergoes in the course of development is similar to what has been observed in the fresh-water bivalves by some continental naturalists, as well as more recently by Professor Lovén of Stockholm in the young of *Kellia rubra*, but as these are viviparous, the metamorphosis takes place before extrusion. Professor Lovén has, however, traced the same metamorphoses in the young of *Modiola discors* (*marmorata*), commencing about the third day after the deposition of the spawn. In the present instance the process likewise commenced about the same time after extrusion, but from the artificial position in which the animal had been placed, there is a possibility that the birth may have been premature, especially as some species of the family are known to be viviparous.

EXPLANATION OF PLATE VI. B.

Fig. 1. *Montacuta ferruginosa*, magnified.

Fig. 2. Anterior portion of the cloak more highly magnified.

Fig. 3 to 7. Different stages in the development of the embryo.

Fig. 8. Shell in the embryo state.

XXI.—*Characters of several new East Indian and South African Helices, with remarks on some other species of the Genus occurring at the Cape of Good Hope.* By W. H. BENSON, Esq.

1. *Helix Ampulla*, nobis, n. s.

T. imperforata, oblique globoso-ovata, tenuissima, irregulariter plicato-striata, striis antice obsoletioribus, transverse et oblique rugosa, olivacea; anfractibus 3 velociter crescentibus, ultimo inflato, apice convexo-depresso; apertura parum obliqua, rotundato-ovali, intus concolori, peristomate acuto, margine columellari arcuato, tenui, intrante.

Diam. maj. 42 mill., minor 31 mill., axis 30 mill.

Hab. Khoorda Ghat, in montibus Nilghiri dictis, Indiæ Meridionalis. Teste Jerdon.

The strong horny epidermis occupies nearly as much of the

substance of the shell as the calcareous matter, which is exceedingly thin and tender. The shell bears very much the appearance of a large globular *Vitrina*, for which it has been taken; but the rough surface of the shell shows that it has been formed by an animal of very different organization, and its affinities place it near the singular and beautiful *Helicophantoid Helices Waltoni* of Ceylon, and *magnifica* of Madagascar.

2. *H. cacuminifera*, nobis, n. s.

T. obtecte perforata, conica, trochiformi, cornea, spira versus apicem attenuata, apice papillari, obtusiusculo; anfractibus 8, lente crescentibus, supra planatis, spiraliter lineis septem minute moniliferis, lineisque intermediis minutioribus similibus munitis, ultimo acute compresso-carinato, subtus convexo, polito, radiato-striato; apertura securiformi, peristomate acuto, labio superne vix dilatato, reflexo.

Diam. major 19, minor 16, axis 10 mill.

Hab. in cacuminibus montium Nilgheries, teste Jerdon.

A shell singular both in form and sculpture. The profile of the spire is somewhat concave owing to the attenuation of the spire towards the apex.

3. *H. crinigera*, nobis, n. s.

T. anguste umbilicata, depresso-trochiformi, cornea, radiato-costulata; apice obtusiusculo; anfractibus 6-6½, vix convexiusculis, linea unica elevata supersuturali munitis; ultimo carinato, carina suturaque pilis elongatis ciliatis, basi planiuscula, ad umbilicum compressiuscula, lineis impressis concentricis frequentibus ornata; apertura obliqua angulato-lunari, securiformi; peristomate simplici, acuto.

Diam. major 12½, minor 12, alt. 6½ mill.

Hab. ad latus montium "Nilgheries" versus Orientem spectans. Teste Jerdon.

This shell in size and characters is intermediate between *Helix Guerini*, Pfr., an inhabitant of the summits of the Nilghery Mountains, and *H. retifera*, Pfr., which inhabits the warmer valleys of the same range according to Dr. Jerdon, to whom I am indebted for specimens of all the three species from the localities indicated.

4. *H. acuducta*, nobis, n. s.

T. perforata, tenui, lenticulari, conica, acute carinata, superne costulato-striata, lineis impressis confertissime granulato-decussata, subtus lævigata, lineis impressis frequentibus concentricis notata; spira vix elevata, apice obtusiusculo; anfractibus 5, planulatis, fere contabulatis, ultimo subtus tumido, carina infra compressa; apertura

angulato-lunari, subsecuriformi; peristomate tenui, simplice, margine columellari superne brevissime reflexo.

Diam. major 22, minor 19, alt. 11 mill.

Hab. in sylvis ad apicem montium "Nilgheries," Indiæ meridionalis. Jerdon.

This form seems to rank between the perforate *H. anceps*, *H. Indica*, &c., and the umbilicated *H. Guerini*, *H. retifera*, &c. At first sight it has the aspect of a depressed and much-carinated dextrorse *Helix interrupta*, Bens., a species which is, however, invariably sinistrorse.

5. *Helix regalis*, nobis, n. s.

T. perforata, sinistrorsa, conoideo-depressa, carinata, eleganter fasciata vel unicolori; anfractibus 6, angustis, subplanatis, supra striis acute corrugatis, obliquis, strias spirales decussantibus, medianis obsolete noduloso-costatis, ultimo carinato, carina infra compressa, subtus nitido, convexo, radiato-striato, striis circularibus versus umbilicum obsoletis; periomphalo excavato; apertura obliqua, subsecuriformi, peristomate acuto, margine inferiori arcuato, versus umbilicum sinuato, columellari brevissime reflexo.

The following is a more extended description of the differences observable in the specimens examined:—

A. costis inconspicuis; anfractibus supra fascia media luteo-fusca, utrinque linea fusco-nigra marginata, fasciisque albido-cæsiis marginalibus ornatis, ultimo subtus fascia media, cinereo-lutea, lata, utrinque fascia angusta purpureo-fusca cincta, margine albido, periomphalo albido-luteo.

B. unicolori, extus intusque purpureo-fusca, costis magis conspicuis.

Diam. maj. 27, minor 25, axis 13 mill.

Hab. ad Sarawak, Insulæ Borneo. Teste W. Taylor.

A couple of specimens of each variety, found on the ground, in jungle, near Sir Jas. Brooke's house at Sarawak, were brought to England by Lieut. W. Taylor, Madras Artillery, to whom I am indebted for an example of each kind. The subnodulous costate appearance of the whorls, above the ultimate one, forms a very peculiar feature in this handsome sinistrorse species.

The following corrected and more extended characters of a fine and remarkable East Indian *Helix*, published by me in the Journal of the Asiatic Society of Calcutta for 1836, and copied thence into Pfeiffer's 'Monograph,' will not be out of place here.

6. *Helix Oxytes*, nobis. Amended character.

T. late umbilicata, orbiculari, depressa, oblique subplicata, ferrugineo-cornea, spira convexa, apice planato; anfractibus $5\frac{1}{2}$ subplanatis, contabulatis, ultimo carinato, subtus tumidiusculo; sutura vix marginata; apertura subquadrato-lunata, valde obliqua, intus albida,

polita, marginibus acutis expansiusculis, callo tenui junctis, inferiori valde arcuato, subreflexo; umbilico lato, profundo, omnes anfractus exhibente, margine subcompresso.

Diam. major 47, minor 40, axis 15 mill.

Benson, J. A. S. vol. v. p. 351.

Pfeiffer, Monograph, vol. i. p. 395. no. 1028.

Hab. in montibus præter fines provinciæ Bengalix orientales versus septentrionem spectantes.

The remaining species belong to the south-western termination of the African continent, and are not the only species which escaped the researches of Krauss in the immediate vicinity of Cape Town.

7. *Helix Cotyledonis*, nobis, n. s.

T. imperforata, depresso-turbinata, tenui, læviuscula, diaphana, corneo-fusca, opaciter albo-zonata; spira elevata, apice obtuso; anfractibus 5, convexiusculis, fascia lata alba superficiali, fusco interrupte striata, superne ornatis; ultimo subtus convexo, rude radiato-subplicato, fasciis duabus similibus angustis cincto; apertura obliqua, lunata, intus fuscata; peristomate recto, acuto, margine columellari breviter reflexo, arcuato, intrante, calloso; callo umbilicum omnino tegente.

Diam. major 16, minor 14, axis 9 mill.

Hab. prope Simon's Bay, P. B. S.

I got a single fresh and perfect example adhering to the fleshy leaf of a species of *Cotyledon*, among bushes, on the sand-heaps near the Round Battery at Simon's Town, Cape of Good Hope, in October 1846. Weathered shells, which were whitish, with a fuscous stain underneath, occurred in the drifting sands, with the reversed *Pupa Pottebergensis*, Krauss, and *Cyclostoma affine*, Sow.

There is a single bad specimen of *H. Cotyledonis* in Case 25 of the British Museum collection, without name or locality; and in Case 26 are two smaller examples, in worse condition, presented by Professor M'Gillivray, and marked "from Simon's Bay."

8. *Helix vorticialis*, nobis, n. s.

T. late umbilicata, subdiscoidea, superne depresso-planata, tenui, rufescente-cornea; spira concaviuscula; sutura profunda; anfractibus 4, angustis, convexis, confertim radiato-plicatis, penultimo prominente, ultimo subtus valde convexo; umbilico lato, profundo, omnes anfractus exhibente, margine subangulato; apertura verticali, lunata, subcompressa, marginibus rectis tenuibus, callo tenuissimo junctis.

Diam. major 6, minor 5, axis 3 mill.

Hab. ad Promontorium Bonæ Spei, rarior, sub lapidibus.

Unfrequent near Three-anchor Bay, Green Point; and at Camp

Ground near Rondebosch, adhering to the undersides of stones ; alive in May and July 1846 ; dead at "the Strand," False Bay.

Helix pulchella, well-distinguished by Pfeiffer's diagnosis from *H. costata*, Müller, and which has been noticed as occurring in Europe, from Ireland to Russia, and from Sweden to Switzerland, as well as in Madeira, and through a considerable portion of North America, has extended its range to the Southern hemisphere. I gathered specimens under stones lying on the lawn of High Constantia, near the south-east extremity of Table Mountain. Another European species, *H. cellaria*, is tolerably abundant in the hollows of decayed oaks and willows, in the neighbourhood of Rondebosch, as well as under stones, &c. on the ground. It was probably imported originally from Holland with the trees which it frequents.

Among described indigenous shells, *Helix Menkeana*, Pfr. (of which Krauss obtained only a single specimen on the stem of a *Protea*, near Elim in Zwellendam) occurred to me in bushes shooting out of the sand-hills which border the head of Hout Bay, south of Table Mountain ; but it was deficient in similar localities explored near Cape Town and in False Bay.

Helix globulus, Müller (*H. Lucana*, Lamk., nec Müll.), is to be found within a few hundred yards of the coast, both of Table and False Bays, and never, as far as my observations extended, much inland. It burrows in the earth and in sand, and only makes its appearance in the very wettest weather during the winter season, when it may be taken emerging from the ground, or may be traced from its earth-cast. The deserted shells are alone observable at other seasons. The specimens obtainable on the shores of False Bay are larger and more brilliantly coloured than those of Table Bay, and belong to the var. *rosacea* (*H. rosacea*, Lamk.). Krauss notes the species as being only subfossil at Green Point, but I have taken it alive on several parts of that shore.

Helix Capensis, Pfr., is also exclusively a shore-loving species. It is exceedingly abundant on the borders of Table and False Bays and at Green Point, on stones and grass above high-water mark, and for a few hundred yards inland. Those of the southern shores exceed in beauty the shells of the western coast, being variously marked with reddish brown bands or radiate stripes. An internal rib rarely occurs in the right lip, a character which is not noted by Pfeiffer.

February 1850.

BIBLIOGRAPHICAL NOTICES.

The Natural History of Ireland.—Vols. I. and II. *Birds, comprising the Orders Raptores, Insessores, Rasores, and Grallatores.*
By WILLIAM THOMPSON, Esq.—London: Reeve, Benham and Reeve.

THE first and second volumes of a work bearing the above title now lie upon our table; and the portion devoted exclusively to the Birds of Ireland will be completed in the third, which we believe is now in an advanced stage of preparation. Two volumes out of the three on this subject having now appeared, we feel we are in a position to state to our readers the plan and general arrangement of the work, and to express our opinion of its value as a contribution to our scientific literature.

In the pages of this journal, under its former title, there was commenced in the year 1838 a series of papers by Mr. Thompson on the Birds of Ireland, which was continued at intervals until 1843. It related to the birds comprised in the orders *Raptores*, *Insessores* and *Rasores*. All that was valuable in those papers has been transferred to the first volume of the present work and to the early part of the second volume, but with copious and valuable additions. Neither the *Grallatores* nor the *Natatores* have hitherto been systematically treated of by the author.

It is obvious that the two volumes now before us present in many respects a striking contrast. One treats of the birds of prey, and also of those “feathered choristers” which give melody to every brake, or whose graceful and easy flight realise to our eye the very poetry of motion. It comprises the birds of two orders (*Raptores* and *Insessores*). The other also treats of two orders (*Rasores* and *Grallatores*), and brings before us the heathy slope on which the grouse is sought by the sportsman, the bog with its “wisps” of snipe, and the calm sea-bay where flocks of dunlins, comprising many hundred individuals, dazzle the eye one moment by their brightness, and, in their changeable flight, become invisible the next. Such and so varied are the contents of these two volumes. We shall now state the purpose for which they appear to have been written, and a few of the leading points of interest which they embrace.

The author states his opinion—in which we entirely concur—that “every country should possess a natural history specially appertaining to itself.” For such a work he has been for a quarter of a century assiduously collecting the materials, on nearly every branch of which, as he himself informs us, he has matter almost ready for the press. The present volumes he expressly states are “put forward merely as supplementary to the several excellent works already published on British Ornithology.” For this reason, descriptions of form or plumage are in most instances omitted; when introduced they refer to some rare visitant, where critical examination and measurement seem, from the circumstances of each case, to be demanded.

In Mr. Thompson’s “Additions to the Fauna of Ireland,” and in all his former papers, our readers may recollect the precision with

which dates and localities were given, and the scrupulous exactness with which he acknowledged to all his correspondents his obligation for the facts they had communicated. The same trait of character is apparent throughout the present volumes. In fact, he modestly remarks in the preface, "that the work should rather be considered that of Irish ornithologists generally than of the individual whose name appears on the title-page."

To one who takes up a volume merely for the purpose of amusement, and who, in the words of Sterne, is "pleased with a book he knows not why and cares not wherefore," the detailed enumeration of dates, names and localities will no doubt be irksome, although even to such a reader, the work, replete as it is with varied anecdote, cannot fail to be attractive. But to those who read with a higher aim and for a loftier purpose, such details will assume a different aspect; and those whose range of ornithological reading is the most extended will most prize this positive information, and will draw from it oft-times an inference, perhaps a generalization, which but for such well-attested facts, they would not feel warranted in doing.

There is another light in which these details, though detracting to some extent from the popular character of the work, are even more valuable. They vouch for the fidelity of this record of the Birds of Ireland, as at present known by one who has spent a large portion of his life in their investigation. Fifty years hence, if any writer should take up the same subject, the present work will afford him a firm basis from which to start. Taking its record as true at this time, he will compare it with what he then finds around him, and note the changes that have taken place. Such changes are continually in progress, as evidenced in the present volumes. In the preface to the first, we have a very striking example of the extent to which birds are influenced by the labours of man:—

"It is interesting to observe how birds are affected by the operations of man. I have remarked this particularly at one locality near Belfast, situated 500 feet above the sea, and backed by hills rising to 800 feet. Marshy ground, the abode of little else than the snipe, became drained, and that species was consequently expelled. As cultivation advanced, the numerous species of small birds attendant on it became visitors, and plantations soon made them inhabitants of the place. The land-rail soon haunted the meadows; the quail and the partridge the fields of grain. A pond, covering less than an acre of ground, tempted annually for the first few years a pair of the graceful and handsome sandpipers (*Totanus hypoleucos*), which, with their brood, appeared at the end of July or beginning of August, on their way to the sea-side from their breeding haunt. This was in a moor about a mile distant, where a pair annually bred until driven away by drainage rendering it unsuitable. The pond was supplied by streams descending from the mountains through wild and rocky glens, the favourite haunt of the water-ouzel, which visited its margin daily throughout the year. When the willows planted at the water's edge

had attained a goodly size, the splendid kingfisher occasionally visited it during autumn. Rarely do the water-ouzel and kingfisher meet 'to drink at the same pool,' but here they did so. So soon as there was sufficient cover for the water-hen (*Gallinula chloropus*), it, an unbidden but most welcome guest, appeared and took up its permanent abode; a number of them frequently joining the poultry in the farm-yard at their repast. The heron, as if conscious that his deeds rendered him unwelcome, stealthily raised his 'blue bulk' aloft, and fled at our approach. The innocent and attractive wagtails, both pied and gray, were of course always to be seen about the pond. A couple of wild-ducks, and two or three teal, occasionally at different seasons, became visitants; and once, early in October, a tufted duck (*Fuligula cristata*) arrived, and after remaining a few days took its departure, but returned in company with two or three others of the same species. These went off several times, but returned on each occasion with an increase to their numbers, until above a dozen adorned the water with their presence. During severe frost, the woodcock was driven to the unfrozen rill dripping into it beneath a dense mass of foliage; and the snipe, together with the jack-snipe, appeared along the edge of the water. The titlark, too, visited it at such times. In summer, the swallow, house-martin, sand-martin and swift displayed their respective modes of flight in pursuit of prey above the surface of the pond. The sedge-warbler poured forth its imitative or mocking notes from the cover on the banks, as did the willow-wren its simple song. This bird was almost constantly to be seen ascending the branches and twigs of the willows (*Salix viminalis* chiefly) that overhung the water, for *Aphides* and other insect prey. In winter, lesser redpoles in little flocks were swayed gracefully about, while extracting food from the light and pendent bunches of the alder-seed. Three species of tit (*Parus major*, *cæruleus* and *ater*), and the gold-crested regulus, appeared in lively and varied attitudes on the larch and other trees. In winter, also, and especially during frost, the wren and the hedge-accentor were sure to be seen threading their modest way among the entangled roots of the trees and brushwood, little elevated above the surface of the water.

"So far only, the pond and bordering foliage have been considered: many other species might be named as seen upon the trees. On the banks a few yards distant, fine Portugal laurels tempted the greenfinch to take up its permanent residence, and served as a roost during the winter for many hundred linnets, which made known the place of their choice by congregating in some fine tall poplars that towered above the shrubs, and thence poured forth their evening jubilee."

The bittern, which has been observed in several localities in each of the four provinces of Ireland, is now becoming scarce, owing to the drainage of the bogs and marshes. A time may come when

"Deep-waving fields and pastures green"

will occupy the swampy solitudes in which it now dwells, and the

species, after gradually becoming more and more rare, may hereafter become altogether extinct. The records now given of its occurrence will then acquire an importance beyond that with which they are at present invested. The same observation applies to many other birds yet indigenous to Ireland. Already several species, which were at one time abundant, have become extinct, or are only known as rare visitants, and the author has not failed to supply, from all authentic sources, such particulars respecting them as are most worthy of preservation.

The situation of Ireland gives interest to a comparative list of its birds with those of Great Britain; and accordingly Mr. Thompson has appended to each order a valuable summary, showing at a glance the species peculiar to the respective islands. The differences between them are not to be accounted for by local causes, such as mineralogical structure or climate, but must be attributed to the laws of *geographical* distribution. In this respect, all that pertains to Ireland and distinguishes it from other European countries becomes of philosophical interest, considered in connexion with its insular position, and its being the most western of all European lands.

In reading Mr. Thompson's pages, we do not receive information merely with reference to the birds of Ireland as compared with those of Great Britain, but not unfrequently we have tidings of their migrations, habits and comparative abundance, both in the Arctic circle and in the sunny isles of the Ægean. In this way it occasionally happens, that the author leads us with him almost insensibly to brighter skies and classic scenes, so fraught with pictorial and poetic interest, that we are tempted to forget the measured language of the reviewer of a scientific work, and express without reservation the delight which the reading of certain passages has afforded. As an example, we would refer to the bee-eater, vol. i. p. 367 :—

“I have had the gratification of seeing the bee-eater in scenes with which its brilliant plumage was more in harmony than with any in the British Isles. It first excited my admiration in August 1826, when visiting the celebrated grotto of Egeria, near Rome. On approaching this classic spot, several of these birds, in rapid, swift-like flight, swept closely past and around us, uttering their peculiar call, and with their graceful form and brilliant colours proved irresistibly attractive. My companion, who, as well as myself, beheld them for the first time, was so greatly struck with the beauty of their plumage and bold sweeping flight, as to term them the presiding deities over Egeria's Grotto. Rich as was the spot in historical and poetical associations, it was not less so in pictorial charms; all was in admirable keeping :—the picturesque grotto with its ivy-mantled entrance and gushing spring; the gracefully reclining, though headless white marble statue of the nymph; the sides of the grotto covered with the exquisitely beautiful maiden-hair fern in the richest luxuriance; the wilderness of wild flowers around the exterior, attracting the bees, on which the *Merops* was feeding; and over all, the deep blue sky of Rome completing the picture.”

Or another instance may be selected relating to the rock-dove, vol. ii. p. 13 :—

“ The mention of various places in connexion with this bird induces me to remark, though at the expense of the repetition of a few names, that nearly as the ring-dove and the rock-dove, distributed in suitable localities over the British Islands, are allied, their haunts are very different ; the former being associated with the tender and the beautiful, the latter with the stern and the sublime in nature. The ring-dove is most at home in the lordly domain, rich in noble and majestic trees, the accumulated growth of centuries. The stately beech, beautiful even in winter, when with grayish-silver stem it towers upwards from its favourite sloping banks,—richly carpeted in the russet hue of its fallen leaves,—and expands into a graceful head of reddish branches, affords the species nightly shelter. The same tree, too, may have cradled the infant ring-dove ; and when the bird became mature, fed it with its ‘ mast.’ The rock-dove, on the other hand, has its abode in the gloomy caverns both of land and sea. How various are the scenes—nay, countries and climates—brought vividly, with all their accompaniments, before the mind, by the sight of this handsome species ! A brief indication of the nature of a very few may here be given ; and in the first place, of two similar in kind, but ‘ yet how different ! ’ The most northern great water-fall at which this bird has come under my notice is that of Foyers, in Inverness-shire, where its habitation,

‘ Dim-seen through rising mists and ceaseless showers,
The hoary cavern, wide-surrounding, lowers.’

“ Over this fall ‘ the evergreen pine ’ presides in majesty, and the surrounding scenery partakes of the fine bold character of the ‘ land of the mountain and the flood.’ From the banks above, we may, however, in a serene day, gaze across the lengthened expanse of Loch Ness as it sleeps in azure, and over the steep mountain-sides that rise from its margin richly wooded with the graceful weeping birch (the predominant species), the hazel, and other indigenous trees, until the eye rests on the somewhat distant and lofty pyramidal summit of Maelfourvonie. The most southern locality of a similar kind, in which rock-doves attracted my attention, was amid the enchanting scenery of the Sabine hills, about the celebrated cascade of the Anio at Tivoli, where, numerous as domestic pigeons in a well-stocked dove-cot, they appeared flying in and out of the gloomy recesses of the rocks close to where the mass of waters was precipitated. The cliffs above these falls are crowned by the ruins of the Corinthian temple of Vesta ; from the neighbouring hill-sides the great aloe and the myrtle spring spontaneously, while the most antique of olive-trees, many of them even grotesque from the decrepitude of age, form the chief features of the foliage. Afar, over the dreary Campagna, Rome, once mistress of the world, appears.

“ In the snow-white caves adjacent to Dunluce Castle, near the Giant’s Causeway, and those darkly pierced in the long range of stupendous cliffs at the Horn in Donegal, which boldly confront the At-

lantic, southward to those of Sphaacteria whose precipices are laved by the waters of the eastern Mediterranean, I have remarked that the rock-dove equally finds a home; as it likewise does in islets from the high and rugged promontory of Oe, in Islay, off the south-western coast of Scotland, to the 'Isles of Greece.'"

If from considering the range of species, and the circumstances which invest them with adventitious interest, we confine our attention to individual species as observed in Ireland, we find abundance of material, carefully collected and judiciously brought together. Under this head we might refer to the full and accurate manner in which the food of each is noted, after the author's personal examination of the contents of the stomachs of different individuals. His critical knowledge of species, both of plants and of those invertebrate animals that afford the means of subsistence to numerous families of birds, becomes here of great importance, and has enabled him to treat this part of his subject with a completeness which is rare, if not unequalled.

The number of quails which appear to winter in Ireland, forms a singular point of contrast between Great Britain and the sister island. The woodcock, on which notes of the highest interest are given, suggests a similar comparison. But perhaps there is no species which offers more numerous topics than the heron (*Ardea cinerea*). We are accustomed in Britain to regard it as solitary in its habits during the winter; in the Bay of Belfast it becomes gregarious, and flocks of from thirty to sixty are mentioned. Their appearance, whether perched on trees, congregated in meadows and ploughed fields, or mustered on the beach, is described—sometimes as seen in bright sunshine, and at others as they pursue their piscatory vocation by the light of the moon.

The book abounds with anecdotes illustrative of habits, and told in a most attractive style. We might refer as examples of this to the land-rail (vol. ii. p. 317), or to the heron in confinement (vol. ii. p. 152). Perhaps however a still more attractive little "bit" of biography may be found in the history of a pet magpie, vol. i. p. 334, or that of three redbreasts, vol. i. p. 167.

One who studies, as Mr. Thompson has done, the habits of birds amid their native haunts, where alone the true enjoyment of ornithological pursuits can be felt, is brought at times into the midst of scenery, which the mind that is alive to what is beautiful in nature, cannot contemplate unmoved. It is but natural therefore that the author should occasionally turn from the birds to the scenery in which they are found. Of this we have examples in vol. ii. pp. 55, 246.

On the whole, we have no hesitation in saying that this book must take its place by the side of those which are justly regarded as standard works on Ornithology. Its facts will commend it to the man of science, and the manner in which they are conveyed will win for it a ready admission to many a domestic circle. We hail it as a valuable addition to our literature, and shall look forward with impatience for the remaining volumes.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

April 24, 1849.—William Spence, Esq., V.P., F.R.S., in the Chair.

The following papers were read :—

1. ON A NEW SPECIES OF THE GENUS *GLAREOLA*.

By G. R. GRAY, F.L.S. ETC.

GLAREOLA NUCHALIS.

Brownish ash tinged with bronze, paler on the throat and breast, and darkest on the quills and tail; a white line commencing at the gape and extending round the nape, thus forming a prominent collar; the base of the tail-feathers, with the space gradually enlarging to the outermost, and the tips of the third, fourth and fifth feathers, white; the abdomen and under tail-coverts ashy-white; the two longest of the latter with a broad patch near the tip of each dark brownish ash.

Bill black, with the base yellow; feet yellow, with black claws.

Total length, $5\frac{1}{2}$ " ; bill from gape, 8" ; wings, $5''\ 7'''$; tarsi, 9" ; middle toe, 8" .

The bird here described was discovered by Francis Galton, Esq., at the fifth cataract of the Nile. This species may prove eventually to be found also on the Quorra, Western Africa, as is partly shown by an immature specimen in rather bad condition, which is contained in the collection at the British Museum.

2. DESCRIPTION OF A NEW SPECIES OF THE GENUS *CULTRIDES*.

By G. R. GRAY, F.L.S. ETC.

CULTRIDES RUFIPENNIS.

Head, neck, and breast, blue-black, tinged in some lights with green; the back and smaller wing-coverts olivaceous; the greater wing-coverts and the outer webs of the secondaries bright cinnamon; the inner webs of latter and primaries dark violet; the throat and lower part of breast and abdomen ashy-white; the middle feathers of the tail changeable bronzy-green; the second, third, and fourth feathers, dark green slightly tinged with bronze on the outer margins, the first feather on each side dark violet-blue. Bill black, with the tip white; the legs and feet pale.

Total length, 1' 10" ; bill to gape, 2" 4" ; wing, $7\frac{1}{2}$ " ; tail, 1' ; tarsi, 2" 7" .

This bird, which is supposed to be a native of Mexico, forms a second species of the genus *Cultrides*, which was established by M. Pucheran, with the *Coccyzus Geoffroyi* of M. Temminck for its type.

May 8, 1849.—Harpur Gamble, Esq., M.D., in the Chair.

The following papers were read :—

1. ON A VERY LARGE ROE-DEER (*C. leucotis*) IN THE COLLECTION OF THE EARL OF DERBY. By J. E. GRAY, ESQ., F.R.S. ETC.

The President has sent for exhibition a stuffed specimen of a female

Deer, which has lately been obtained by him from Valparaiso, and is a native of South America. It evidently belongs to the genus *Capreolus* or Roebucks.

I may observe that most of the groups into which the Deer have been divided are strictly geographic divisions; the only exception is in the Stags, or the restricted genus *Cervus*, one species of which is found in America. The following animal appears to be a similar example in the genus *Capreolus*, which has hitherto been restricted to species found in the Old World.

In size it agrees with the specimens of the male Ahi or *C. pygargus* from Siberia in the British Museum collection, being at least three times as large as the usual European Roebucks; but it differs from that species in being much darker, in not having the white spot which extends over the upper part of the sides of the haunches, and in having the greater part of the front of the chin and a spot on each side of the upper lip white, instead of the lip and chin being nearly black, as in that species.

In all the characters above noted it agrees with the European Roebuck, as it also does in the greater stoutness of the legs and the greater length of the face. Indeed I can see no difference between it and the European Roebuck, except in the greater size, the greater length of the quills, and their more distinct and broader subterminal yellow bands, and in the hair on the inside of the ears being whiter; but in the latter character it also differs from *C. pygargus*.

I think it may be distinguished by the provisional name of *C. leucotis*.

Sundevall observes of *C. pygargus*, "A priori (*C. Europæus*) non minus differt quam omnes Cervi indici inter se; hi igitur, non minus quam ille, distinguendi, sed rectius forsân ut meræ varietates habendi."—*Pecora*, 61.

I have seen six specimens of the Ural species, and they were all alike, and very distinct from any variety of the European Roebuck I have seen, especially in the form of the head and the extension of the white disk over the sides of the rump, forming a broad oblong white spot; while in the European species it is an erect longitudinal disk only, occupying the back part of the haunches.

The height at the shoulder of Lord Derby's specimen is 38 inches. His Lordship's correspondent states, "It was brought to Valparaiso by Don Benjamin Munoz, a Commodore in the Chilian Navy. The animal was shot by one of the Chileno officers about twenty leagues from Port Famine in the Straits of Magellan. The Indians assured the officer that there was another similar kind of Deer there, but quite white. He did not see any of them, but the other kind (*C. leucotis*) did not seem uncommon."

2. ON THE GENUS *BRADYPUS* OF LINNÆUS. BY JOHN EDWARD GRAY, ESQ., F.R.S. ETC.

Illiger, and afterwards F. Cuvier, divided the Linnæan genus *Bradypus* into two, according to the number of the claws and the absence or presence of the canine, and the form of the crown of the grinders.

The examination of the collection of skulls of the family in the collection at the British Museum, has induced me to believe that the recent species may be divided into three very distinct subdivisions, and that there are at least seven distinct species.

Synopsis of Genera.

1. *CHOLÆPUS*.—Hands two-clawed, feet three-clawed; front grinder large, like a canine; pterygoid bone rather swollen, sub-vesicular.

2. *BRADYPUS*.—Hands and feet three-clawed; front grinder small; pterygoids swollen, hollow, vesicular.

3. *ARCTOPITHECUS*.—Hands and feet three-clawed; front grinder small; pterygoids compressed, crest-like, solid.

I. *CHOLÆPUS*, Illiger (1811); *Bradypus*, *F. Cuvier, Dent. Mamm.* t. 77; *Bradypus*, sp. *Linn.*; *Tardigradus*, sp. *Brisson*.

Hands two-clawed, feet three-clawed. Grinders: front upper and lower large, like canines; the upper ones separated from the other grinders by a broad space, with a deep concavity in front, at the back edge of the teeth. Intermaxillary bones small, distinct, and produced in front, with a long canal behind them; pterygoid bones separate, rather swollen, spread out on the sides, thick, with a moderate internal vesicular cavity.

Lower jaw much-produced in front between the teeth.

The skull of this genus is well-figured by *M. Cuvier, Oss. Foss.* v. t. 5, and *M. De Blainville, Ostéograph.* *Bradypus*, t. 1; skeleton, t. 3. f. 1, 2, old and young skull.

1. *CHOLÆPUS DIDACTYLUS*.

Bradypus didactylus, *Linn.*; *Cuvier, Oss. Foss.* v. 73. t. 6; t. 7. f. 3, 5; skull, cop. *Cuvier, Règ. An. Illust.* t. 70. f. 2; *Blainv. Ostéog. Bradypus*, t. 1. t. 3. f. 13; *Guérin, Icon. R. A.* t. 33. f. 2–2 a, skull.

B. Unau and B. Curi, *Link*.

We have three more or less perfect skulls from different-aged individuals of this species.

The projection in the front of the lower jaw in the young specimen is narrow and acute; it then becomes thin, wider and rounded at the end, and in the adult skull it is thickened, prolonged, and again becomes rather more acute.

In the adult skull there are very large air-cavities between the parietes of the bones, and a considerable cavity in the pterygoid bone.

In the younger skull the pterygoid bone is small, and appears to be nearly solid, but there is a very large circular perforation which communicates with a cavity under the pterygoid bones, which is nearly entirely obliterated in the adult skull; and the intermaxillary bones of the two young skulls are much less projecting than those of the adult one.

The young skull exhibits a small, distinctly tapering, produced, additional central nasal bone, which is not preserved (or not to be found) in the adult one, or in any of the other skulls of the family which have come under my observation.

The hinder angle of the lower jaw of the two skulls, the one of a young and the other of an adult animal, in the Museum collection, is nearly similar in form. The condyloid process of the young is short and truncated behind, that in the older jaw being produced and bent back at the tip.

In the British Museum collection there are five skins of adults, two very young, one dry, the other in spirits, and three skulls more or less perfect.

The very young specimen in spirits in the British Museum is figured in Griffith's Animal Kingdom, and Seba figures the *fœtus* from spirits.

II. BRADYPUS. ? *Acheus* pars, *F. Cuvier, Dent. Mamm.* t. 78; *Guérin*. *Bradypus* pars, *Linn.* *Bradypus*, *Illiger*. *Tardigradus*, sp. *Brisson*. *Arctopithecus*, *Gesner*.

Hands and feet three-clawed. Skull flattened above on the forehead. Grinders: front upper small, cylindrical; front lower small, transverse, compressed. Intermaxillary bones none, or very rudimentary. The upper process of the zygomatic arch with a broad process in front, forming a back edge to the orbit. Pterygoids separate, much-swollen and raised, very thin, enclosing a large vesicular cavity.

Lower jaw produced in front between the teeth, flattened.

Cuvier, *Oss. Foss.* v. 88, described the skull of this subgenus.

Blainville (*Osteograph.* *Bradypus*, t. 3) figured an imperfect skull of a young animal under the name of *B. torquatus*, but it does not show the characters of the pterygoid process, and it has no appearance of the anterior process on the upper part of the zygomatic arch forming the upper hinder part of the orbit, which is found in most of the skulls of this genus. This skull may be the one described by Cuvier, as M. Blainville observes that the skull he figures formed part of the old collection, and was taken from a skin collected in Brazil by M. Delalande.

1. BRADYPUS CRINITUS.

Greyish, sides reddish; back of the neck with a mane formed of elongated black hairs.

B. crinitus, *Browne, Jam.* 489.

B. tridactylus, *Linn. Am. Acad.* i. 487; *Syst. Nat.*; *Shaw, Mus. Lever.* t. 3; *Nat. Misc.* t. 5; *Griffith, A. K.* v. t. 135.

B. tridactylus, var. *c.* *Desm. Mamm.*

? "*B. variegatus*, *Schinz, Cuvier, Thierre*, iv. 510" ?

B. torquatus, *Illiger, Prod.* 109; "*Temm. Ann. Gen. Sci. Phys.* vi. 212. t. 91;" *Fischer, Syn. Mamm.*; *Geoff. Ann. Mus.*

Acheus torquatus, "*Geoff.*" *Guérin, Iconog. R. A.* t. 33. f. 1 & 1 a, skulls.

B. cristatus, "*Temm. MSS.*" *fide H. Smith, Griff. A. K.* iv. 271. *Ai à collier*, *Cuvier, Oss. Foss.* v. 88.

Three-toed Sloth, *Penn. Syn.* t. 29 (from B.M.).

Ignarus, *Clusius, Exot.* 110 fig. 372 fig.

Unau, Laet. Amer. 618. f. 618. cop. *Clusius* fig. at p. 372.

Ai sive Ignarus, *Marcgrave, Brazil*, 221. fig. cop. *Clusius*, 372.

Hab. British Guiana; *Schomburgk*.

This is evidently the species described and figured by Clusius (Exot. 111), for he observes, "*Collum non adeo crassum ut pictura refert, quia oblongioribus densisque pilis, quemadmodum et totum corpus, tectum erat: pilorum color ex fusco quodammodo spadiceus, sive potius qualis fere in crassiore illa lanugine magnas et crassas Indicas nuces tegente conspicitur;*" and better described and figured at p. 373 as follows: "*Universum corpus a summo capite ad ungues usque, densissimis iisque prolixis villis erat obsitum, coloris partim nigri, partim cineracei, pæne ut meles, quem vulgus tassum sive taxum appellat, mollioribus tamen, atque a collo secundum dorsi longitudinem, usque ad posteriora fere crura, nigrorum pilorum quadam serie erat insignitum: totum collum a cervice ad anteriora usque crura veluti juba quadam nigrorum crinium in utrumque latus propendentium tectum habebat.*"

Maregrave gives a copy of the second figure in Clusius (at p. 221), but with a rather different description, viz. "Totum corpus prolixis et duo digitos pæne longis pilis est vestitum cinerei coloris. Tarsi similis sed mollioribus et cum abbedine nucis in dorso pilis magis albescunt et per medium dorsi tendit linea fusca a capite, per colli longitudinem pilis jubæ modo ad latera explicantur paulo longiores quam in reliquo corpore." (p. 221.)

The forehead (of the skull) flat over the orbit, rather concave between the front of the temple, wide and rather depressed over the occiput. The pterygoid bones much-swollen, very thin, paper-like. The lower jaw with a broad square truncated process in front between the teeth, the sides converging, with the outer edge reflexed; the angle broad, acute, slightly produced beyond the back edge of the condyles. Teeth large, broad, the lower front one oblong, transverse: the lower process of the zygoma broad, flat, dilated.

The skull is easily known from the next by being much wider in all its parts compared with its length; this is especially visible at the occipital ridge and the palate, and on the under side of the lower jaw.

The *Sloth* figured by Edwards (Gleanings, t. 310) is from a badly-preserved specimen in the collection of Lord Peters, brought from Honduras. It appears to belong to this species, being the only one having long hair on the neck, but the black colour of this crest is not mentioned in the description.

Bradypus tridactylus, Linnæus, was first described by that author in the *Amœnitates Acad.* i. 487, but the description is so slight that it is not possible to determine with certainty the specimen for which it is intended, the only specific character being the following: "*facie vero pilis flavis vestitum; gula flava, totum corpus ursorum instar, pilis longis et asperioribus vestitur colore ex fusco sive griseo et albo variante.*" In the *Mus. Adolph. Fred.* p. 4, Linnæus refers to this description. The mixed colours of the first description and the habitat Surinam best agree with this species.

Gmelin merely described this species as "*Corpus pilosissimum griseum, facies nuda, gula flava.*"

Browne (Jamaica) mentions it as an animal which is sometimes brought from the mainland to Jamaica (not as a native of the island); his name at once shows that it must belong to this species.

The skull above described was taken from the skin of a specimen in the British Museum. We have also a skeleton of a second specimen, which was received from M. Becker under the name of *Bradypus torquatus*, from Brazil.

2. BRADYPUS AFFINIS.

Fur unknown.

The forehead of the *skull* rather convex, with a slight convexity over the orbits and a higher convexity over the front part of the temples. The occipital ridge very concave and rather narrow. The pterygoid bones rather swollen, rather compressed on the sides, and moderately thick. The lower jaw with a broad, gradually tapering, truncated process in front between the teeth; the sides rather curved, simple-edged beneath; the angle broad, acute, slightly produced beyond the back edges of the condyles. The lower process of the zygoma slender, tapering. Teeth moderate, the lower front one much-compressed, transverse, linear.

Hab. Tropical America.

The skeleton from which this skull has been described was received by the British Museum from M. Brandt, under the name of *Bradypus torquatus*, from Brazil.

It has been suggested that the two skulls in the Museum which have been extracted from skins of *Bradypus crinitus*, may both belong to male or female animals, and that the skull here described may belong to the other sex. As this is a matter of doubt which can only be settled by the examination of more specimens the sexes of which are known, I have considered it desirable that the skull should be figured and described. I may remark that the form of the hinder side and angle of the lower jaw of all the three specimens of these skulls are very similar.

<i>Skull.</i>	<i>B. torquatus.</i>		<i>B. affinis.</i>	
	in.	lin.	in.	lin.
Length	2	9½		
Length of palate	1	2		
—— from palate to occipital hole .	1	4		
Breadth at occipital ridge	1	4½	1	2½
—— at front of ear-hole	1	5	1	2½
—— at front of zygoma	1	10	1	8
<i>Lower jaw.</i>				
Length	2	4	2	2½
Width at condyles	1	8	1	4½
—— of back part of them	0	11	0	10

III. ARCTOPITHECUS. *Bradypus*, sp. *Rüppell*; *Pr. Max.*; *Cuvier*, *Oss. Foss.*; *Blainv.* *Acheus*, *F. Cuvier*, *Dent. Mamm.* t. 78. *Tardigradus*, sp. *Brisson*.

Hands and feet three-clawed. Skull rounded above on the forehead. Grinders: front upper very small, cylindrical; front lower smaller than the others, subcylindrical. Pterygoid separate, compressed, erect, thin, simple. Intermaxillaries none.

Lower jaw not produced on the upper edge between the teeth, but slightly keeled in front of the chin.

Face with a black streak from the back angle of the eye.

Cuvier, Oss. Foss. v. t. 4, figured the skeleton, and t. 5, the skull and bones of the feet of this genus; the skull is copied R. A. Illust. t. 70. f. 1 *a*. Wiedemann, Arch. Zool. und Zoot. i. t. 1 and 1*, and Spix, Cephal. t. 7. f. 12, figure the skull, and Blainville figured two skulls belonging to this genus in his 'Osteographia.'

In the young skull there is sometimes a slight projection on the front edge of the zygomatic arch, assisting to form the back edge of the orbit, but this process seems soon to disappear as the animal increases in size, and I have not found it in any of the older skulls.

Cuvier, Desmarest, and most French authors, have considered all the individuals of this genus as belonging to one species, and have given an indefinite description, so as to include them. Cuvier (Règ. Anim. ed. 1. 217) thus describes that species: "Sa couleur est grise, souvent tachetée sur le dos de brun et de blanc: plusieurs individus portent entre les épaules une tache d'un fauve vif que traverse une ligne longitudinale." He refers for the species to both *Buffon's figures*, xiii. t. 5 & 6. In the second edition he remarks, "On connaît un *Ai* dit la *dos brûlé*, parce qu'il a entre les épaules une tache noire entourée de fauve; ce n'est selon M. Temminck, qu'une variété résultant de ce que des longs poils de ses épaules sont usés."—Cuvier, Règ. Anim. ed. 2. p. 225.

Desmarest describes it in nearly the same words, but he notices four varieties, including amongst them *B. crinitus* (var. *c.*); the special description of the species and var. *b.* appear to be *A. gularis*; var. *a.* appears to be from a female, and var. *d.* from a male of *A. flaccidus*.

Knorr (Délices, i. 97. t. K. f. 3) figures the fœtus of a species of this genus.

a. Fur moderately rigid; the back white-spotted; dorsal streak elongate.

1. ARCTOPITHECUS GULARIS.

Dark grey-brown; back white varied, with an elongated black streak, with a broad patch of soft yellow hair on each side between the shoulders. Skull with a broad forehead, rather convex over the back part of the orbits. The upper front grinder rather large. The hinder side of the lower jaw concavely cut out, and with the lower angle slender and acutely produced; front of the lower jaw flat, not keeled up the suture.

Bradypus gularis, Rüppell, Mus. Senckenb. iii. t. 11.

Ai à dos brûlé, Buffon, Hist. Nat. xiii. 62.

Ai adult, Buffon, Hist. Nat. xiii. t. 6.

B. tridactylus, Griffith, A. K. iv. 271.

B. tridactylus, description and var. *b.* Desm. Mamm.

D'*Ai B. tridactylus*, var. Cuvier, Règ. Anim. Illust. Mamm. t. 70. f. 1.

A. tridactylus, var. *Cuvier*, *Oss. Foss.* v. t. 5. f. 1, 2, 3, skull; cop. *Cuv. R. A. Ed. Illust.* t. 70. f. 1 a.

B. tridactylus β , *Fischer*, *Syn.* 387.

Hab. Bolivia, *Bridges*; Guiana, *Rüppell*.

This species was well-described by Buffon, and is at once known by its dark colour, white varied back, and the yellow patch of soft hair between the shoulders.

Cuvier states (*Règ. Anim.* ed. 2) that M. Temminck thought that the yellow spot on the back depended on the skin being worn in that part. Probably he never saw a specimen, or he could hardly have made such an observation.

According to Mr. Waterhouse, Mr. Bridges considers the specimens here described as the males of *A. marmoratus*.

Cuvier's upper figure of the skull (fig. 1) most accurately represents the form of the hinder end of the lower jaw, the other figures being distorted by the perspective position.

There are two specimens in the Museum collection, one half the size of the other; the smaller specimen is yellower on the face and much darker on the neck, forming a nearly black collar, and the white is smaller in quantity and more mixed with the grey-brown of the back. The larger one is probably a male, which according to the observations of the Prince of Wied is whiter than the female.

2. ARCTOPITHECUS MARMORATUS.

Grey-brown, back and outer side of the arms white varied, with an elongated narrow streak extending nearly the whole length of the back.

The angle of the lower jaw longly produced, narrow, subacute.

B. tridactylus, var. *Griffith*, *A. K.* t. 136.

Bradypus tridactylus Guianensis, *Blainv. Osteogr. Brad.* t. 3.

Hab. Brazil; *Gordon Graham*, *Esq.*

This species, which is the most common in English collections, is easily known by the whiteness of the back and limbs, which is well-defined from the uniform dark grey-brown tint of the rest of the body; the dorsal streak is always very distinctly marked, and, as in *A. gularis*, reaches nearly to the rump, while in *A. flaccidus* it is confined to the upper part of the back.

In 'Griffith's Animal Kingdom' there is a figure by T. Landseer of this species, taken from an adult specimen in spirits in the British Museum, which appears to have formed part of Sir H. Sloane's collection; but the character of the colouring of the back is not well-shown, and it may represent either *A. marmoratus* or *A. Blainvillii*.

In the British Museum there is a nearly adult and a young specimen of this species. The specimens agree in all points of external colouring with the following species (*A. Blainvillii*); but the form of the lower jaw at once separates it both from *A. gularis* and *A. Blainvillii*. It may be the female of the former, the skull having more alliance to that species than to *A. Blainvillii*.

The front of the lower jaw of the older specimen is rather promi-

nent, while that of the younger individual is truncated and quite destitute of any convexity or keel, like the adult skull of *A. gularis*.

3. ARCTOPITHECUS BLAINVILLII.

Grey-brown, back and outside of the arms white varied, with an elongated narrow streak extending nearly the whole length of the back; the forehead very convex and swollen over the back of the orbit. Teeth rather large; front lower compressed.

Lower jaw distinctly keeled up the symphysis, and slightly angularly produced on the front edge.

B. tridactylus Braziliensis, *Blainville, Osteog. t. 2, skeleton*; 3, skull partly broken.

Hab. Tropical America.

We have three specimens of the animal agreeing with the skulls here described, but they offer no external character by which I can distinguish them from the preceding specimens (*A. marmoratus*); yet the skulls all agree in the greater convexity of the forehead and in the form of the angle of the lower jaw. Two of the lower jaws have a distinct angular ridge up the front symphysis.

It has been suggested that the differences in the form of the hinder part of the lower jaw, which, it should be observed, are not the only, but are the most easily described characters to separate these species, are not sufficient for specific distinction. I am willing to own that it is a fair question of discussion, and one that can only be settled by the comparison of more specimens than we at present possess. Should these variations prove only individual, and not specific, then it must lead us to be very cautious in the formation of species on the examination of skeletons alone, as is of necessity the case in the animals now only found in a fossil state.

b. Fur elongate, very flaccid, whitish; dorsal streak very short, indistinct, only seen where the hair is worn.

4. ARCTOPITHECUS FLACCIDUS.

Pale grey-brown; back, sides of the back and hinder part white varied, with a short blackish dorsal streak between the shoulders. Skull with a broad rather convex forehead. (3 spec.)

Ai (seconde), *Buffon, Hist. Nat.* xiii. 62.

Jeunes Ais, Buffon, H. N. xiii. t. 5.

Bradypus tridactylus, Temm. Ann. Gen. Sci. Phys. vi. 51, not *Linn.*; *Pr. Max. Abbild. Nat. Braz.* t. . ♀ & jun.; *Beitr. zur Nat.* ii. 482.

B. tridactylus, var. *a.* ♀?, *Desm.*, and var. *d.* ♂, *Mamm.*

Var. 1. White grey-brown; back of the hairs blackish, with a short black streak, and with a white spot on each side between the shoulders. (1 spec.)

Hab. Venezuela; *Mr. Dyson.*

Var. 2. Nearly uniform whitish grey-brown; base of the hairs blackish, without any dorsal streak. (1 spec.)

Hab. Para; *J. P. G. Smith, Esq.*

This species, of which we have four specimens of different ages in the Museum, is easily known by the length, very loose and flaccid nature of its hair, and the indistinctness of its markings. The black on the back appears to arise from the hair of the shoulders being worn away. Three, of very different ages, are pale grey-brown, with a short, broad, blackish streak between the shoulders, and have the rump and each side of the dorsal streak more or less white, and an indistinct whiteness on the outer side of the upper arms.

Buffon's description of his second specimen of *Ai* agrees better with this species than with any other which has come under my observation.

Prince Maximilian gives a good figure of the female and young of this species. He observes, "*Les mâles a de chaque côté du dos une ligne longitudinale blanche.*"

In the British Museum there is a specimen about half the size of the largest of the former, which is very like it in the flaccid nature of its fur, but the whole upper part of the body is pale whitish grey, with two or three indistinct white spots on the sides, and there is a short black streak edged with a white spot of soft hair on each side between the shoulders. This was brought from Venezuela by Mr. Dyson.

There is another specimen rather smaller than the former, and like it in colour and appearance, but it has no indications of the back streak or white soft hair on the shoulders. Brought from Para by my son-in-law, Mr. J. P. George Smith.

I am by no means certain that these specimens may not be indications of the existence of other species, which can only be proved by the comparison of more specimens.

Besides these species of which we have skins and skulls, there is in the British Museum the skeleton of a species of this genus, which was sent from Para by my son-in-law, which differs essentially from all those before described, both in the greater length of the head and in the form of the hinder edge of the lower jaw, and which I have therefore indicated under the name of

5. ARCTOPITHECUS PROBLEMATICUS.

Fur unknown. Skull rather elongate; forehead broad, rather convex on each side over the middle of the orbit.

Lower jaw with a broad rather produced angle, bent up at the tip and regularly rounded beneath, and with a distinct angular keel up the symphysis, rendering the upper edge angularly produced.

Hab. Para; J. P. George Smith, Esq.

The keel in the lower jaw is similar to that of *A. Blainvillii*, but the angle is much more produced. In the form of this part it most resembles that which I have considered as the young of *A. flaccidus*; but the angle is much broader and more recurved, and it differs from both skulls of that species in the skull, and especially the lower jaw, being much more elongated behind compared with the length of the tooth-line.

MISCELLANEOUS.

Notice of Powerful Bears, probably coæval with the Great Fossil Deer of Ireland.

[From Proceedings of the Royal Irish Academy, Dec. 10, 1849.]

MR. BALL, on the part of Abraham Whyte Baker, sen., Esq., of Ballaghtobin, a member of the Academy, and one who has always endeavoured to promote its objects, presented accurate casts of two bear skulls found in the county of Westmeath. The following is a summary of the information Mr. Ball has been able to obtain relative to these very interesting relics of a powerful species long extinct in this island. Mr. Underwood, the well-known and industrious collector of antiquities, who has rescued from destruction many of the best specimens of human art now in the Academy's museum, being in 1846 on one of his tours through the country, discovered at the house of Mr. Edward Fermon, of Forgney, County Longford, on the borders of Westmeath, between Moyvore and Ballymahon, the skull of an animal to him unknown. This he lost no time in securing, and in the following year obtained a second specimen, found in the same place, in a cut-away bog, about seven feet from the original surface. These skulls were purchased by Mr. Baker, and are the originals of which casts are by his desire presented to the Academy, being duplicates of others given by him to the University Museum, where are now to be found, through the generosity of the Earl of Enniskillen, the East India Company, and our Zoological Society, a very instructive collection of the remains of bears, both fossil and recent.

On the discovery by Mr. Underwood of the larger skull, it was somewhat hastily announced as that of a great Irish wolf-dog, and was published in the newspapers as such. Under this impression it was brought to Mr. Ball, who, without hesitation, pronounced it to be that of a bear, which, on a little further investigation, he considered to be the black bear of Europe. Soon after, Mr. Baker, with laudable liberality, purchased both specimens, and has thus preserved evidence of the existence of bears in Ireland, of which we had before no tangible proof or historical evidence. Dr. Scouler, in a paper on extinct animals of Ireland, published in the first volume of the Geological Transactions, observes, that while bears still maintained their ground in England, they were unknown in Ireland. The Venerable Bede states, the only ravenous animals of Ireland were the wolf and fox. Giraldus makes no mention of the bear; and St. Donatus, who died in 840, states it was not a native, "*ursorum rabies nulla est ibi,*" &c.

The late Mr. Richardson, through whose kind interference Mr. Ball obtained leave to make moulds of the skulls, appears to have been in much doubt as to their nature. He states (in his History of Dogs, p. 36) his opinion, that "they are the remains of an extinct animal allied to, but by no means identical with, the dog; and an animal with which we are now unacquainted, partaking somewhat of the characteristics of the bears, and perhaps, also, of the hyænas."

Mr. Ball observed that the discrimination of skulls of bears presented zoological difficulties quite sufficient to account for the erroneous views which had been taken: the alterations of age in the occipital and sagittal crests, the dropping of the premolars, and, in some cases, of the incisor teeth, were quite sufficient to mislead, and had often misled naturalists; but the structure and arrangement of the molar teeth, and the peculiar depressed form of the bullæ tympanicæ, are unerring proofs of the Ursidæ, at all times distinguishing them from Dogs.

Mr. Ball then proceeded to remark, that if any evidence were wanted to prove that the skulls alluded to were Irish, he could supply it by producing a cast of a third specimen, from which he had been kindly allowed to take a mould for the University Museum by its owner, Mr. Cooke of Parsonstown; the original had been found in Mr. Cooke's neighbourhood, as Mr. Ball understood, in deepening a river. He mentioned also that he had heard from the late Mr. John Robinson, of that locality, of the discovery and wanton destruction of skulls on his grounds, which were very possibly those of bears. It is probable that the bear and great Irish deer were involved in one common catastrophe, and perished together.

Mr. Ball stated, that being desirous of confirming the accuracy of his own views, he submitted casts of the skulls to the greatest living authority, merely stating that they were supposed to be Irish, and requesting an opinion as to their species. The following note is the reply to his questions:—

“College of Surgeons, London, Dec. 7, 1849.

“MY DEAR BALL,—The casts of the fine crania of bear duly arrived, and I have been comparing them this morning. They all differ from *Ursus spelæus* in the minor elevation of the forehead, and what is more decisive, in the smaller relative sizes of the last molar, upper jaw; they also retain the first premolar. The largest of the three skulls presents a close correspondence of general form and of flatness of forehead with the largest of our old male skulls of *Ursus maritimus*, but the molars are relatively larger, especially the last, in the Irish skull; this is decisive against *Ursus maritimus*. I regret that I have no skull at command of a good old male *U. ferox*. A young female skull of that species indicates the proportions of the molars to be similar to those in the Irish specimens; but then the proportions of the teeth in question are likewise those of *Ursus arctos*; and the two smaller skulls from Ireland show an elevation of forehead, which, though less than in *U. spelæus*, is greater than in any specimen or figure that I have seen of *U. ferox*. There remain, therefore, for comparison, the varieties of *Ursus arctos*, for the tropical Indian and Malayan bears have characteristics too well-marked and well-known to be dwelt on.

“The great black variety of the European *Ursus arctos* is that to which the Irish skulls offer the nearest resemblance. I can find no character in the casts of the skulls which you have sent that I could point to as a specific distinction; but then I must add, that I feel equal difficulty in laying down the specific distinction between the

Ursus priscus of Goldfuss from Gailenruth cavern, and the existing largest varieties of *Ursus arctos*, or the Irish bears. These specimens have much strengthened, if not quite confirmed, a growing suspicion that *U. priscus* is specifically identical with, and was the progenitor of, our European *U. arctos*; at the same time, they prove that *U. priscus* was not the mere female, as M. De Blainville believes, of *U. spelæus*. Your three specimens are all of the same species; the largest is the male, the smallest with well-worn molars, the female. Now the large male skull establishes the specific distinction of the equally large male *Ursus spelæus*, and consequently the specific and not merely sexual distinction of *U. priscus*; but at the same time, the Irish crania show that the character of the forehead alluded to in my 'British Fossil Mammalia,' p. 83, is not constant, and not good for a specific difference with *Ursus arctos*. To conclude, then, as at present informed, I should refer your Irish skulls to *Ursus arctos*; and the least degenerated representative of that species now living, viz. the great black bear, or very dark brown variety of the Scandinavian wilds, is that which comes closest to the old Irish bears. Whether this respectable carnivore continued to exist after the slaughter of the last megaceros, will be shown by the precise bed in which the specimens were found. I should like to know the authority, if any, for their derivation from peat bog, and not from shell marl, if the case be so.

"Ever yours,
" (Signed) R. OWEN."

Mr. Ball was of opinion, from examination of the original bear skulls, that they were not in the peat, but in the marl below it, where he believed all the heads of the megaceros, probably fifty, which he had closely inspected, were found. In no case was peat to be discovered in the cavities, while in many marl was present. He expressed his gratification in finding that his own views were supported by those of Professor Owen, from whom, on this and other occasions, he had received kind aid. He also expressed his obligations to the Earl of Enniskillen, Mr. Baker, Mr. Cooke, and Mr. Warren, and concluded by moving the thanks of the Academy to Mr. Abraham Whyte Baker, sen., for his kindness in presenting casts of his valuable specimens to its museum of antiquities.

On the employment of Tar to preserve Wheat from the Attack of the Weevil. By M. CAILLAT.

In a late number of the 'Comptes Rendus' a note appeared by M. G. Barruel relative to the action of carbonic oxide upon weevils and the employment of this gas for their destruction. Some journals, and among others 'L'Écho Agricole,' very lately published another means of destroying these insects, pointed out by Mr. William Little, and which consists in the use of ammoniacal gas. This young English chemist states that in the presence of this gas the weevils perish instantly, as if struck by lightning.

I have proved, before several witnesses, that ammonia does not kill

the weevils, for after remaining some minutes in the gas or in the ammoniacal liquid, they get on their feet again, and run about perfectly when removed from the influence of the caustic alkali. However, the prolonged action of this gas, like that of carbonic oxide, carbonic acid, or any other gas not respirable for large animals, kills these insects in a shorter or longer time. I know not what arrangement of a simple and economical kind, within the reach of all cultivators, large and small, rich or poor, would be adopted by M. G. Barruel for the application of the carbonic oxide, or by Mr. W. Little for that of ammonia; but I must point out a substance, the use of which is much more practical and less expensive, namely tar. The efficacy of this substance against the weevils is known to many agriculturists and corn-merchants.

I placed, in a half-pint bottle, well closed by a cork, three very lively and healthy weevils; at the same time I introduced a small open phial containing a little tar; presently the uneasiness of these animals was perceptible; they soon fell on their back, shaking their feet without being able to use them to get up again. The smell alone of the tar, in a close space, is therefore fatal to these insects. If the upper part of the closed vessel in which the weevils are shut up be smeared with tar, they die more quickly.

The efficacy of tar, in driving away these insects and preserving the corn, is an incontestable fact. My father had, a long time ago, his granaries, barns and the whole house infested by weevils, so much so that they penetrated into all the chests and among the linen. He placed an open cask impregnated with tar in the barn, and then in the granaries; at the end of some hours, the weevils were seen climbing along the walls by myriads, and flying in all directions away from the cask. On moving this tarred vessel from place to place, the house was in a few days completely cleared of these troublesome and pernicious guests.

The agriculturist who wants to get rid of weevils, may, as soon as he perceives their presence, impregnate the surface of some old planks with tar, and place them as required in his granaries; care must be taken to renew the tar from time to time in the course of the year to prevent the return of the insects.—*Comptes Rendus*, Oct. 15, 1849.

DR. ROBERT BALL.

We have had much pleasure in noticing and commending the encouragement which the study of Natural History receives in Ireland, and to record with great satisfaction that the degree of LL.D. has been conferred by the Board of Trinity College, Dublin, upon Robert Ball, Esq., who has for some time had the Museum of the College under his superintendence, and whose efforts for the advancement of Natural History in general, and of Zoology in particular, are universally known. With similar feelings of pleasure, as to the interests of our favourite pursuit and of other branches of learning, we look upon the appointments in the recently established colleges, from which the happiest results are to be expected.

METAMORPHOSES OF DONACIA SAGITTARIA.

In this notice M. Perris gives some details on the mode of life of the larvæ of the *Donacia*, of which little was previously known. They live on *Sparganium ramosum*, near the roots and at the base of the leaves, which are immersed, for the greater part, in water, feeding on the sap rather than on the tissue of the plant.

How do these larvæ respire under water, as they have no branchial organs? M. Perris thinks that the respiration is effected by means of endosmosis, which occurs through the membrane covering the stigmata.

When the larva is about to undergo its metamorphosis, it buries itself in the mud in which the plant is rooted, and forms upon the root an elliptical cocoon, which is not of a silky nature, but of a dry gummy substance, about the thickness of a sheet of paper.

The author was not able to observe this larva whilst forming its cocoon, and only ventures suppositions as to the mode which it employs to construct this case without allowing a single drop of water to penetrate into it.—*Bibliothèque Universelle de Genève*, June 1849.

WILD ANIMALS OF ANCIENT BRITAIN.

To the Notes in Vol. iii. Ser. I. p. 356 and Vol. iv. Ser. II. p. 423, on the Wild Animals of Britain, and the Huntings of the Citizens of London, may be added the following, in which it appears that the Wild Cat is enumerated.—R. T.

Rotuli Hundredorum. 3^o Edwardi I. Membr. 13.

Item dicunt, Quod Libertas Civitatis Domini Regis talis est: Quod Cives, cum canibus suis possunt currere ad Lepores Vulpes Cuniculos et Murelegos [Catos*] usque ad Pontem de Stanes; et ad janua[m] Parci de Enfende, et ad Arcubus de Stratforde, et ad Crucem de Wantham; sed ista libertas impeditur per Warennam Comitis Cornubiæ, apud Histleworth†, et Warrenam Willielmi de Say, apud Edelmeton‡; nesciunt quo warranto.

“Wild cats,” says Pennant, “were formerly reckoned among the beasts of chase; as appears by the charter of Richard the Second to the Abbot of Peterborough, giving him leave to hunt the hare, fox, and wild cat. The use of the fur was in lining of robes, but it was esteemed not of the most luxurious kind; for it was ordained ‘that no abbess or nun should use more costly apparel than such as is made of camel’s or cat’s skins.’ In much earlier times it was also the object of the sportsman’s diversion.

Felemque minacem
Arboris in trunco longis præfigere telis.
Nemesiani Cynegeticon, L. 55.”

* In the copy of the roll in the Chapter-house, Westminster, Membr. 3, the reading is “Catos.”—Murilegus, Voss. Felis.—*Du Cange*, v. Catta, Cattus.

† Isleworth.

‡ Edmonton.

Errata in Mr. Babington's Paper on Chara.

P. 84. *C. mucronata* was found at *West*, not *East* Grinstead.

P. 91. *C. aspera*. Mr. Borrer did not find this nor any other species at Carlton, Notts; that station therefore must be erased.

P. 91. *C. Hedwigii*. For *East* read *West* Grinstead.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1850.

Chiswick.—January 1. Sharp frost: fine: cloudy. 2. Hazy: fine. 3. Foggy: hazy. 4. Foggy: overcast: clear. 5, 6. Frosty: very fine: clear and frosty. 7. Sharp frost: clear: severe frost at night. 8. Frosty: overcast. 9. Slight fall of granular snow: overcast. 10. Snowing slightly: overcast. 11. Hazy throughout. 12. Slight snow: dusky: hazy. 13. Hazy: clear and frosty. 14, 15. Cloudy and cold. 16, 17. Densely overcast. 18. Foggy: snow at night, with heavy rain. 19. Cloudy: drizzly. 20. Frosty. 21. Cloudy. 22. Hazy. 23. Hazy: clear at night. 24. Foggy and drizzly. 25. Foggy: densely overcast: rain at night. 26. Densely clouded: showery. 27. Sudden rise of barometer: frosty: very fine. 28. Overcast. 29. Very fine: rain. 30. Foggy: very fine. 31. Hazy and cold: heavy rain at night.

Mean temperature of the month 33°·11

Mean temperature of Jan. 1849 39°·56

Mean temperature of Jan. for the last twenty-four years . 36°·60

Average amount of rain in Jan. 1·60 inch.

Boston.—Jan. 1. Fine. 2. Cloudy. 3, 4. Cloudy: rain P.M. 5—8. Fine. 9—11. Cloudy. 12. Cloudy: snow A.M. 13. Fine. 14—17. Cloudy. 18. Cloudy: snow and rain P.M. 19. Cloudy: rain early A.M. 20. Cloudy: snow A.M. 21, 22. Cloudy. 23. Fine. 24. Cloudy. 25. Fine. 26. Cloudy: rain and snow P.M. 27. Fine. 28. Cloudy. 29, 30. Fine. 31. Fine: rain P.M.—N.B. This has been the coldest January since the year 1838.

Applegarth Manse, Dumfries-shire.—Jan. 1. Frost: dull and threatening change. 2. Thaw: small rain. 3. Thaw: drizzle. 4. Slight frost early A.M.: rain and wind P.M. 5. Snow half an inch deep: frost. 6. Frost very hard: snow lying. 7, 8. Frost very hard. 9. Frost very hard: thermometer 11°. 10. Cloudy, looking like change. 11. Cloudy, but still freezing. 12. Still slight frost, but unsettled. 13. Frost still slight: cloudy. 14. Frost, slight A.M.: harder P.M. 15. Bright and clear: hard frost: a little snow. 16. Frost: slight shower of snow: looking dull. 17. Hard frost: clear: snow lying. 18. Hard frost, and heavy snow 4 inches deep. 19. Frost not so hard: thaw P.M.: frost again. 20. Frost: additional sprinkling of snow. 21. Frost hard again. 22. Frost moderate. 23. Thaw: mild: cloudy. 24. Thaw: snow melting fast. 25. Rain in the night: thaw continuing. 26. Thaw A.M.: came on to freeze at 6 P.M. 27. Hard frost A.M.: thaw and rain P.M. 28. Heavy rain: snow nearly gone. 29. Slight frost A.M.: keener P.M. 30. Frost moderate: snow all gone. 31. Slight shower of snow A.M.: frost: rain P.M.

Mean temperature of the month 30°·8

Mean temperature of Jan. 1849 36°·3

Mean temperature of Jan. for the last twenty-eight years. 34°·9

Average amount of rain in Jan. for the last twenty years. 2·60 inches.

Sandwick Manse, Orkney.—Jan. 1. Cloudy. 2. Bright: fine: rain. 3. Showers: sleet-showers. 4. Thunder: sleet-showers. 5. Thunder: showers. 6. Sleet-showers. 7. Sleet-showers: clear. 8. Cloudy. 9. Rain: cloudy. 10. Cloudy: sleet-showers. 11. Cloudy: clear. 12. Snow-showers: cloudy. 13. Cloudy: frost: aurora. 14. Snow-showers: snow-drift. 15. Snow-drift. 16. Snow-drift: snow: thaw. 17. Rain: clear: frost: aurora. 18. Clear: frost: cloudy. 19. Snow-showers: cloudy: aurora. 20. Cloudy. 21. Cloudy: thaw. 22. Showers: drizzle. 23, 24. Drizzle. 25. Cloudy: snow-showers. 26. Snow-showers: snow: clear. 27. Snow: frost: snow-showers. 28. Showers: drizzle. 29. Bright: large halo. 30. Fine: frost: clear: aurora. 31. Bright: rain.

Days of Month.	Barometer.				Thermometer.				Wind.				Rain.								
	Chiswick.		Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.		Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Dumfries-shire.		Orkney, Sandwick.		
	Max.	Min.	8½ a.m.	9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.	8½ a.m.	Max.	Min.	9 a.m.	8½ p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. Jan.																					
1.	30-271	30-213	29-97	30-13	30-12	30-14	30-09	35	19	27-5	34	26	45	41	w.	nw.	s.	.....	.....	.....	.....
2.	30-223	30-221	29-96	30-08	30-06	29-98	29-87	39	27	31	40	30	42	43	nw.	sw.	ssw.	.....	.....	.....	.....
3.	30-201	29-996	29-84	29-89	29-70	29-63	29-48	44	38	33	42	40	42	42	nw.	ssw.	w.	.....	.....	.....	.....
4.	29-737	29-445	29-39	29-33	29-15	29-32	29-07	48	26	36	43	34½	40½	38	sw.	w.	se.	.....	.....	.....	.....
5.	29-437	29-127	29-13	29-18	29-26	29-07	29-27	42	21	32	40	31	37½	37½	w.	w.	n.	.....	.....	.....	.....
6.	29-599	29-424	29-22	29-36	29-55	29-40	29-60	35	18	27-5	29	13½	35	37½	e.	nw.	ne.	.....	.....	.....	.....
7.	30-154	29-867	29-62	29-80	30-07	29-94	30-09	36	14	23	27	13	37½	33	n.	nw.	se.	.....	.....	.....	.....
8.	30-330	30-332	29-03	30-20	30-20	30-08	30-09	36	31	31	25	13	39	41	ne.	n.	sse.	.....	.....	.....	.....
9.	30-211	30-065	29-87	30-08	30-05	30-03	30-12	33	29	33	23½	11	37	38	ne.	n.	sse.	.....	.....	.....	.....
10.	29-908	29-824	29-64	29-87	29-65	29-95	29-75	34	28	33	31	20½	37	36½	ne.	n.	se.	.....	.....	.....	.....
11.	29-791	29-760	29-54	29-63	29-78	29-75	30-01	34	27	31-5	31	29	36½	34½	se.	calm	se.	.....	.....	.....	.....
12.	29-922	29-883	29-65	29-90	29-93	30-17	30-27	32	27	30	34½	30	37	37	ne.	e.	se.	.....	.....	.....	.....
13.	29-912	29-882	29-77	30-00	29-97	30-29	30-27	31	22	27	33½	30½	35½	30	ne.	e.	ene.	.....	.....	.....	.....
14.	29-797	29-544	29-65	29-83	29-77	30-08	30-10	31	26	30	33½	30½	34	28½	e.	e.	e.	.....	.....	.....	.....
15.	29-433	29-390	29-30	29-63	29-51	29-98	29-92	31	25	27-5	28½	19	27½	31	e.	calm	e.	.....	.....	.....	.....
16.	29-643	29-143	29-24	29-41	29-55	29-78	29-81	33	29	30	33½	26½	32	36	ne.	nw.	e.	.....	.....	.....	.....
17.	29-944	29-793	29-57	29-73	29-80	29-82	29-86	36	28	33	32	14	35	34	n.	calm	se.	.....	.....	.....	.....
18.	29-984	29-615	29-68	29-73	29-48	29-83	29-76	35	31	30	32	13½	32	35	se.	e.	esc.	.....	.....	.....	.....
19.	29-724	29-437	29-16	29-29	29-70	29-76	30-00	45	27	33	35½	30½	35	33	w.	e.	esc.	.....	.....	.....	.....
20.	30-199	30-047	29-84	29-99	30-05	30-16	30-15	30	27	30	32	29	33½	34½	ne.	e.	se.	.....	.....	.....	.....
21.	30-380	30-227	30-05	30-09	30-19	30-08	30-10	34	26	27	32	25½	35	38	ne.	e.	esc.	.....	.....	.....	.....
22.	30-485	30-481	30-20	30-23	30-24	29-97	30-03	36	31	29	36½	29	44	47	se.	w.	vsw.	.....	.....	.....	.....
23.	30-449	30-397	30-10	30-21	30-22	30-05	30-13	40	25	30	41	35	47	46	sw.	w.	sw.	.....	.....	.....	.....
24.	30-370	30-168	30-00	30-15	29-96	29-93	29-81	36	31	30	40	35½	46	47	w.	w.	w.	.....	.....	.....	.....
25.	29-993	29-724	29-60	29-60	29-43	29-60	29-49	51	45	33	41	36	43	34	sw.	sw.	n.-w.	.....	.....	.....	.....
26.	29-874	29-384	28-96	29-21	29-92	29-71	30-11	51	21	41	36	28½	31	31	w.	w.	ene.	.....	.....	.....	.....
27.	30-452	30-316	30-16	30-27	29-94	30-22	29-77	37	29	23-5	34½	22½	34½	32	sw.	nw.	se.	.....	.....	.....	.....
28.	30-089	29-803	29-60	29-55	29-47	29-08	29-24	49	33	36	46	32½	47	41	sw.	sse.	sw.	.....	.....	.....	.....
29.	30-003	29-879	29-56	29-82	29-96	29-93	30-10	50	32	43	45	34	37	32	ne.	whw.	e.	.....	.....	.....	.....
30.	30-302	30-173	29-91	30-05	30-07	30-15	30-18	42	24	30	37	29	32	30	e.	e.	se.	.....	.....	.....	.....
31.	30-190	29-900	29-90	29-90	29-50	29-99	29-34	50	40	30	43½	31½	37	39	se.	calm	se.	.....	.....	.....	.....
Mean.	30-022	29-831	29-65	29-811	29-814	29-866	29-867	38-58	27-64	31-1	35-4	26-8	37-58	36-70	1-43	1-39	1-90

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XXII.—*Notes on the Salmon and Bull-trout.*

By JOHN BLACKWALL, F.L.S.

IN a short paper on the Salmon, *Salmo salar*, published in the 'Annals and Magazine of Natural History,' vol. xi. p. 409, I have endeavoured, on physiological principles, to establish the fact, that the growth of that valuable fish is not by any means so rapid as it is commonly supposed to be by ichthyologists. Observations having relation to this subject and also to the œconomy of the bull-trout, *Salmo eriox*, have been continued to be made, as suitable occasions presented themselves, up to the present period, on a plan similar to that previously adopted, and I am induced to insist upon the decided advantage which a recourse to physiological phenomena possesses in investigations of this kind over the customary practice of mechanically marking fish as objects of experiment, in consequence of the various sources of error to which the latter mode of proceeding is exposed.

Persons, in their endeavours to determine the rate of growth in fish by marking specimens, too frequently employ subordinate agents to carry their intentions into effect, to whom not only their system of marks is of necessity made known, but the anticipated result is also communicated. Now should it so happen that the agents are dependent upon their employers, or in any respect interested in making the event appear to coincide with their preconceived opinions, the desired object may be easily attained either by secretly marking specimens of a larger size than those which they were instructed and perhaps observed to select for the purpose, and by exhibiting them alone when recaptured, or by adapting the marks to fish subsequently taken, whose dimensions appear to be best suited to promote the end they have in view. Besides, it often happens that all the particulars of the undertaking transpire, and becoming widely circulated, other parties resident in the neighbourhood may apply similar marks to fish of different sizes captured in the same

stream, more especially to kelts, which are comparatively of little value; and that this is not merely a supposititious case, or an imaginary cause of delusion, I can confidently affirm from personal experience. Perforations, and the total or partial excision of any of the fins, may be objected to on account of the modifications which such marks undergo with the growth of the fish, and also on account of the mutilations to which those members are liable from incidental circumstances.

Having thus succinctly directed attention to a few of the objections which may be urged against the manner in which attempts to ascertain the rate of growth in fish by employing artificial marks are generally conducted, I shall revert to the method pursued in my own researches, already referred to at the commencement of this article; namely careful and frequently repeated observations on the gradual loss of the teeth from the vomer, on the order in which they are shed, and on the changes known to take place in the figure of the caudal fin.

The usual number of teeth on the tongue of the salmon-smolt and bull-trout-smolt of six or seven inches in length, when none has been lost, is ten, arranged in a row of five on each side; occasionally I have counted as many as twelve in both species, but ten appears to be the normal number. These teeth are not shed, but most of them are torn away by violence in an irregular manner as the fish advance in growth, so that a want of symmetry in the two rows is conspicuous in much the greater number of individuals. I may remark that such is the case also in every particular with the teeth on the tongue of the common trout, *Salmo fario*.

The teeth on the vomer of the salmon-smolt and bull-trout-smolt commonly exceed twenty (in numerous instances I have noticed twenty-four), a fact which the minute inspection of the heads of both species, after having been placed in nests of the great wood-ant, *Formica rufa*, and subjected to the anatomical process so admirably effected by that industrious insect, fully confirms. Unlike the teeth on the tongue, those on the vomer are shed gradually; commencing at the posterior part and disappearing in nearly regular succession as the fish increase in size; consequently, the loss of teeth from the vomer, taken in conjunction with the form of the tail and the growth of these species, affords to experienced observers a sufficiently exact criterion for determining their relative ages within certain limits.

Smolts of the salmon and bull-trout have the caudal fin much forked; but a progressive alteration in the shape of this organ is effected by the more rapid elongation of its central rays as the fish advance in growth, till, on the acquirement of its perfect development, the posterior margin becomes straight in the

salmon and actually curved outwards in the bull-trout, thus supplying the means of forming a comparative estimate of the ages of both species.

In accordance with what is here stated, I find that specimens weighing from half a pound to a pound and a half have the caudal fin more or less forked, and the vomer well supplied with teeth except at its posterior part, from which some are lost invariably. Specimens weighing from two to five pounds have the posterior margin of the caudal fin either moderately forked, nearly straight, or curved outwards, according to their size and species, and usually have from three to seven or eight teeth on the anterior part of the vomer, the number, after making a suitable allowance for differences in condition, being almost always inversely as the weight; and individuals of large dimensions constantly have the posterior margin of the caudal fin straight or conspicuously curved outwards, and retain one or two teeth only at the anterior extremity of the vomer, or are even without any.

Young salmon and bull-trout weighing from about half a pound to a pound ascend the river Conway during the month of August in much greater numbers than at any other period of the year, and as many of them are infested with that marine parasite the *Caligus curtus* of Müller in various stages of growth, there can be no doubt that they have very recently quitted the salt water. These fish, which from oft-repeated examinations of numerous individuals are found to have the tail forked in a greater or less degree, and uniformly to have lost some teeth from the posterior part of the vomer, though its anterior part is still amply provided with them, I feel thoroughly convinced are identical with smolts of both species which descended the same river in the preceding spring, having then the full complement of teeth on the vomer; for salmon and bull-trout of smaller dimensions do not at any time come up the Conway from the sea, as may be ascertained by actual inspection in calm bright weather, when the water is low and clear and the shoals of fish can be distinctly seen; and if further proof be required, it is abundantly supplied by the conclusive evidence obtained from the large number of specimens taken annually. It is true that I have occasionally procured salmon and bull-trout in the months of March and April which have weighed six ounces only, but they have always been males which had milted or females which had deposited their ova and were out of condition, or what in Scotland are denominated kelts.

I shall here introduce to notice a few examples illustrative of the loss in weight which salmon and bull-trout undergo by the act of spawning.

On the 12th of November 1844, a salmon was captured weighing fifteen pounds, the weight of the lobes of roe, which contained a large quantity of ova in an advanced state of development, being two pounds and three-quarters.

A salmon captured on the 13th of November 1844 weighed seven pounds and a half, and the weight of the lobes of roe, which comprised ova almost in a fit state to be deposited, was two pounds.

A bull-trout taken on the 18th of November 1844 weighed five pounds and a half, the weight of the lobes of roe, which contained ova in an advanced state of development, being one pound and a quarter.

On the 11th of October 1847, a bull-trout weighing half a pound was captured, whose lobes of roe, comprising ova nearly ready for deposition, weighed two ounces.

A salmon weighing fifteen pounds and a half was taken on the 22nd of October 1847, and the lobes of roe, which contained ova in an advanced state of development, weighed three pounds.

The lobes of roe, comprising highly developed ova, taken from a salmon weighing twenty pounds, which was captured on the 10th of November 1847, weighed three pounds and fourteen ounces.

Took the lobes of roe, containing ova on the point of being deposited, from a salmon weighing sixteen pounds, which was captured on the 26th of November 1847, and found their weight to be four pounds.

From these instances it is apparent that the weight of salmon and bull-trout may be diminished one-fourth by the emission of their ova alone, the weight of the collapsed ovaries with their included germs being too insignificant to be taken into consideration; and if to this cause of decreased ponderosity be added another, namely deterioration in condition during the sojourn of these species in fresh water, the absolute loss in weight may be estimated at one-third or more, a circumstance which ought on no account to be overlooked in attempts to determine their rate of growth by marking individuals; and this remark applies with peculiar force when the subjects selected for experiment are kelts, as, unfortunately, it is too commonly the practice to omit measurement altogether on such occasions and merely to give a statement of weight, which, unaccompanied by other data, is evidently insufficient to decide the point in question.

In drawing up this paper I have purposely avoided applying the Scotch term *grilse* to young salmon which have not spawned, as I entertain the opinion that few appellations employed by ichthyologists have been more abused or have led to greater confusion and misapprehension than this.

It appears then, from the physiological facts detailed above, that the growth of the salmon and bull-trout during their first visit to the sea is much less rapid than it is commonly supposed to be; and as in the shoals of these species, which are more abundant in the Conway than any of the other migratory *Salmonidæ*, fish may be observed presenting every gradation of size from the least to the greatest, it is reasonable to infer that their rate of growth is not accelerated materially at any subsequent period of their existence, especially as individuals of large dimensions are found to be very disproportionate numerically to those of a small or even of an average size.

By the cautious inspection of salmon and bull-trout in one of the tributaries of the Conway running through my father's land, up which, when swollen with rain in the months of October and November, they ascend for the purpose of depositing their spawn, and by the frequent examination of their progeny in different seasons of the year, I have satisfied myself that in their œconomy as well as in their rate of growth these species bear a close resemblance to each other. Both remain two years in the fresh water after their extrication from the ovum, during which period, notwithstanding the result of the conclusive experiments so skilfully conducted by Mr. Shaw of Drumlanrig, they are still indiscriminately named parr in this district*, and do not descend to the sea till they have acquired their migratory dress or have been converted into smolts, when they usually measure six or seven inches in length and weigh from an ounce and a half to two ounces. I have ascertained also, by the dissection of very numerous specimens, that the males of the salmon and bull-trout shed their milt before they make their first descent to the sea, but that the females do not spawn till they return from their first visit to the salt water; indeed the ova are so little developed in the month of May, at which time the principal migration seaward takes place, as scarcely to be discerned without the aid of a magnifier.

Among the external characters which serve to distinguish the bull-trout-smolt from the salmon-smolt are a more robust and trout-like figure; a more decided prominence of the row of scales forming the lateral line; a greater number of spots below that line; a yellowish tinge on the lighter-coloured pectoral fins; a bright red tint at the extremity of the adipose fin; and a firmer adhesion of the scales to the skin.

In conclusion, I shall briefly notice a few cases of rapid changes in the colour of fish which have come under my own

* A bull-trout in its second year more nearly resembles a trout than a salmon of the same age.

observation. Trout, suddenly transferred from their natural haunts into wooden, metallic or earthenware vessels supplied with water recently taken from the same stream in which they were captured, speedily assume a lighter hue; and as this change does not appear wholly to depend upon the colour or capacity of the vessels in which they are placed, I am inclined to attribute it primarily to the influence of fear, and in this opinion I am the more confirmed from having frequently perceived a similar transition in the hue of salmon soon after they have been hooked by the angler. That this is not the sole occasion of sudden alterations in the colour of fish I readily admit, for I have often disturbed small flounders in the Conway, which on changing their situation and reposing upon objects of a different hue from those they had last quitted, soon became accommodated to this circumstance of their novel position by undergoing a modification of shade which harmonized with that of their resting-place and effectually served to conceal them from ordinary observation. Even death, as the disciples of Isaac Walton are well-aware, and as the following anecdote clearly proves, does not immediately put a stop to this chameleon-like transition of tint.

A gentleman of my acquaintance, a proficient in the art of fly-fishing, had taken a young salmon weighing about a pound and a half, which, in consequence of having been a long time in the fresh water, had lost its brilliancy and had acquired a very dark aspect; this fish one of my children requested to be permitted to carry, so after having inserted the longer and smaller end of a slender forked twig under one of the gill-covers and drawn it through the mouth till the prize was retained in the angle formed by the fork, I gave it to the boy, who held it suspended with the tail downwards. After the lapse of several minutes, perceiving that the fish had lost all its blackness and had become perfectly bright, I directed the attention of my acquaintance to it, who could scarcely be persuaded that it was the same which he had captured a short time before, but supposed that I had secretly substituted another for it; however, the speedy resumption of its former dark complexion, which underwent no further mutation, completely convinced him of its identity.

I shall not attempt to offer any explanation of the remarkable physiological phenomenon here recorded; but, apart from the mysterious operation of psychological agency, its cause must undoubtedly be sought for in the organization of the rete mucosum.

XXIII.—*Contributions to the Botany of South America.*

By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from p. 210.]

BRUNSFELSIA.

UPON a previous occasion (*huj. op.* iii. 176) I suggested the propriety of again separating *Franciscea* from *Brunsfelsia*, which genera had been united into one, by Mr. Bentham, in his excellent Monograph on the *Scrophulariaceæ* (DeCand. Prodr. x. 198). With the view of carrying out this suggestion, I now offer at greater length the observations on which that recommendation was founded. Although there exists a remarkable similarity in several of their respective features, many essential points of distinction may be observed between them: thus, in *Brunsfelsia*, independently of the constant difference in the yellow colour of the corolla, its tube is always comparatively of much greater length, often ten or twelve times that of the calyx, and in all cases is wider and somewhat funnel-shaped in the mouth; the border too is much broader, of more fleshy consistence, more deeply and unequally lobed, the segments being more or less crenated and crispate and somewhat reflexed; while in *Franciscea* the tube is seldom more than three or four times the length of the calyx, and though suddenly a little inflated above, is again much contracted in the mouth, presenting a conspicuous and prominent rim around its very narrow orifice; the colour of the corolla is constantly of a violet or bluish hue, more or less intense; the lobes of the border are quite flat and rotate, and not at all crispate. The anthers in *Brunsfelsia* are at first 2-celled, with the confluent lobes affixed transversely, thus forming an oblong body grooved across, four times broader than long; this bursts by the upper marginal suture assuming the appearance of being unilocular: it takes a vertical position by the inflection of the filament.

In *Franciscea*, the anther, on the contrary, is always distinctly 1-lobed, 1-celled, almost circular and reniform, fixed at its sinus upon the apex of the filament; it is 2-valved, bursting by a nearly marginal hippocrepiform line, and exhibits in the bottom of the cell a fleshy prominent globular receptacle, to which the pollen-grains are attached, as in *Verbascum*. The stigma is similarly constructed in both genera, as is also the ovarium. In *Franciscea* the fruit is an oval capsule, inclosed within the persistent calyx, and covered with a thick coriaceous pericarp, which in one species almost prevents its dehiscence: in such instances the sutural line is always evident, and by pressure the fruit bursts by

these sutures: in most cases, the capsule (which is 2-locular) splits at its apex by four vertical lines: it presents few seeds (about ten) without any intervening pulp. In *Brunsfelsia*, on the contrary, the fruit is a globular deep orange-coloured drupe many times larger than the calyx, about the size of a small apple, with a soft pulpy envelope inclosing a coriaceous putamen, containing many seeds immersed in a fleshy pulp. *Franciscea* grows only to the size of low bushes or small shrubs, while *Brunsfelsia* attains the dimensions of large trees, *B. undulata* being 20 feet high, and *B. americana* growing to the size of an apple-tree with a trunk as thick as the human body.

BRUNSFELSIA, Sw. (char. reform.).—*Calyx* brevissimus, urceolatus, profunde 5-dentatus. *Corolla* hypocraterimorpha, carnososa, tubo gracili, cylindrico, calyce 4–12-ies longiore, fauce paulo infundibuliformi, limbo valde expanso, obliquo, ad medium 5-fido, lobis inæqualibus, carnosiss, rotundatis, undulato-crispatis, subreflexis, inferiore majori, 2 superioribus minoribus, æstivatione valde imbricatis, maximo exteriori. *Stamina* 4, didynama, inclusa; *filamenta* sursum incrassata et incurva, 2 breviora inferiora et lobo majore opposita: *antheræ* oblongæ, sub-bilobæ, sub-biloculares, lobis transversim latioribus et confluentibus, rima marginali 2-valvatim hiantes, hinc pseudo-1-loculares. *Ovarium* conicum, sessile, glandula basali fere obsoleta, aut nulla, 2-loculare, placentis carnosiss, valde prominulis, dissepimento utrinque adnatis, multi-ovulatis. *Stylus* gracilis, filiformis, longitudine tubi corollæ, apice incrassatus, interdum subincurvus. *Stigma* clavatum, 2-labiatum, lobis rotundatis, semi-globosis, glandula magna viscosa prominula interposita. *Drupa* magna globosa, calyce parva patente suffulta, epicarpio carnosso; putamen cartilagineum, indehiscens, rarius in valvulis 2 separabile. *Semina* plurima, ovata, compressa, subreniformia, *testa* tenui fragili, minute scrobiculata, *integumento* membranaceo, angulo basali *chalaza* fusca notato. *Embryo* in albumine carnosso arcuatus, heterotropus, *cotyledonibus* ovatis, compressis, accumbentibus, *radicula* tereti 2-plo latioribus et 3-plo brevioribus.—Arbores *Antillani*, foliis alternis, integris, oblongis, sæpius nitidis; floribus speciosis, solitariis, vel paucis, subcymosis, terminalibus, corolla flava vel pallide ochroleuca.

1. *Brunsfelsia americana*, Sw., DC. Prodr. x. 200.
2. ——— *undulata*, Sw., DC. Prodr. x. 200.
3. ——— *nitida*, Benth., DC. Prodr. x. 201.
4. ——— *violacea*, Lodd. Bot. Cab. t. 792.—Subglabra, foliis lanceolato-ellipticis, utrinque acuminatis, subundulatis, supra glabris, minute punctato-rugosis, subtus pallide glaucis et pube

glanduloso-pruinoso vestitis, apice utrinque, costa, nervisque subtus prominulis, rubro-violaceis; floribus subsolitariis, corollæ limbo magno, undulato-crispato, flavo, tubo ochroleuco calyce 12-16-ies longiore.—In Antillis, v. v. in hort. *Kew. cult.*

The leaves of this species are 8 inches long, $2\frac{3}{4}$ inches broad, on a thick and deeply channeled petiole less than half an inch in length. The peduncle is $\frac{1}{2}$ inch long, the calyx $2\frac{1}{2}$ to 3 lines, cleft half-way into five obtuse erect teeth with ciliate margins: the tube of the corolla is $2\frac{3}{4}$ inches long, 2 lines in diameter, swelling below the mouth to a width of nearly half an inch; the border is much expanded, and is $2\frac{1}{2}$ inches in diameter*.

FRANCISCEA.

Having offered under the preceding head, the reasons that appear to justify the separation of *Franciscea* from *Brunsfelsia*, I now give the amended character of the former, as contrasted with the latter genus.

FRANCISCEA, Pohl. (char. emend.).—*Calyx* inflato-tubulosus, ore obliquo, 5-dentato. *Corolla* hypocraterimorpha, tubo angustato, apice dorso subinflato, fauce in oram valde prominulam obliquam constricto, limbo obliquo, rotato, expanso, ultra medium 5-fido, lobis inæqualibus, rotundatis, integris, superiore maximo, æstivatione quincuncialiter imbricatis, sinibus introflexis. *Stamina* 4, didynama, inclusa, brevia, infra dilatationem tubi per paria inserta, 2 longiora infra lobum maximum et superiorem sita; *filamenta* carnosula, compressa, corrugata, apice inflexa; *antheræ* reniformes, compressæ, sinu affixæ, 1-loculares, rima marginali 2-valvatim hiantes, receptaculo pollinifero globoso in sinu conspicuo. *Ovarium* obovatum, glandulo carnosulo stipitato imo cinctum, 2-loculare, placentis carnosis, prominentibus, dissepimento utrinque adnatis, multiovulatis. *Stylus* filiformis, apice valde incrassatus et inflexus. *Stigma* 2-labiatum, lobis brevibus, crassiusculis, obtusis, intus glandulosus. *Capsula* ovata, calyce persistente inclusa, coriacea, 2-valvis, 2-locularis, valvis placenta demum libera parallelis. *Semina* pauca, majuscula, oblonga, subangulata, dorso convexa, hilo ventrali, conspicuo, cavo: testa reticulato-foveolata. *Embryo* hilo contrarius, in axi albuminis carnosuli incurvus, cotyledonibus ovatis, compressis, radícula tereti gracili infera triplo brevioribus et 2-plo latoribus.—Suffrutices *Brasilienses et Peruviani*. *Folia alterna, integerrima, oblonga*. *Cymæ terminales, dense capitulæformes vel laxius paucifloræ, rarius ad florem unicum redactæ*;

* This species with generic details will be delineated in 'Illustr. South Amer. Plants,' plate 56.

bractæe parvæ: flores speciosi, violacei, interdum pallidiores, corollæ tubo calyce subæquante, rarius 2-4-plo longiore*.

1. *Franciscea macrophylla*, Cham. Schl. Linn. ii. 601.
2. ——— *hydrangæformis*, Pohl. Pl. Bras. i. 7. tab. 7.
3. ——— *capitata*. *Brunsfelsia capitata*, Bth., DC. Prodr. x. 198.
4. ——— *pauciflora*, Cham. Schl. Linn. ii. 600.
5. ——— *Bahiensis*. *Brunsfelsia Bahiensis*, Bth., DC. Prodr. x. 590.
6. ——— *calycina*. *Brunsfelsia calycina*, Bth., DC. Prodr. x. 199.
7. ——— *obovata*. *Brunsfelsia obovata*, Bth., DC. Prodr. x. 199.
8. ——— *confertiflora*, Pohl. Pl. Bras. i. 6. tab. 5. *F. divaricata*, Pohl. ibid. tab. 6.
9. ——— *ramosissima*, Pohl. Pl. Bras. i. 5. tab. 4.
10. ——— *acuminata*, Pohl. Pl. Bras. i. 4. tab. 3.
11. ——— *latifolia*, Pohl. Pl. Bras. i. 3. tab. 2.
12. ——— *grandiflora*. *Brunsfelsia grandiflora*, Don, N. Edin. Phil. Journ. 1829.
13. ——— *maritima*. *Brunsfelsia maritima*, Bth., DC. Prodr. x. 200.
14. ——— *Hopeana*, Hook. Bot. Mag. t. 2829. *F. uniflora*, Pohl. Pl. Bras. i. 2. tab. 1.
15. ——— *australis*. *Brunsfelsia australis*, Bth., DC. Prodr. x. 200.

MARGARANTHUS.

On a former occasion (*huj. op.* vol. iv. p. 136), although I had not seen any specimen, I noticed this genus in order to contrast it with other allied genera. Since then, I have been glad to meet with a second very distinct species, that has enabled me to comprehend more fully its structural features, and these I find correspond well with the very accurate observations of Prof. Schlechtendal, upon which the generic character (*loc. cit.*) was founded. I proceed therefore to describe the plant alluded to.

1. *Margaranthus tenuis* (n. sp.);—herba glaberrima, dichotome ramosa, ramis divaricatis, tenuibus, angulato-sulcatis; foliis lanceolatis, utrinque acutis, caulinis obsolete paucidentatis, longe et tenuissime petiolatis, junioribus floralibus linearibus; floribus pedunculatis, solitariis, axillaribus.—Mexico (*v. s. in herb. Lindley. Coulter, n. 1220 bis*).

This plant bears much resemblance to that figured by Prof.

* Sectional details showing the characters of this genus will be given in vol. ii. plate 59 A. of the 'Illustr. of South Amer. Plants.'

Schlechtendal. Its stems however are far more slender, more deeply angular, quite smooth, with internodes about 2 inches apart; the radical leaves may probably be of greater size, but the largest leaves in the specimen referred to, are about $1\frac{3}{4}$ inch long, upon a very slender petiole of $\frac{3}{4}$ inch, and are about 4 lines broad, with four or five somewhat obsolete teeth on the margin. The flowers are seen only in the nascent axils, while the young leaves have not attained the length of 4 lines; the capillary peduncle is very hairy, and about 2 lines long; the calyx is scarcely a line in length, cylindrical, and is densely covered, especially below the middle, with articulate and rigid white hairs: the corolla is tubular, and contracted at base to the diameter of one-third of a line, but as it emerges from the calyx, it swells suddenly in a somewhat globular form to a diameter of 2 lines, marked with five grooves opposite the stamens, and five intermediate saccate projections, which are below the five minute short teeth, that crown the suddenly contracted mouth of the corolla, which is here even narrower than the inferior portion of the tube; it is entirely smooth and apparently of a lurid white, the saccate lobes seeming of a dull violet hue; outside it is smooth, inside somewhat hairy; the stamens, nearly the length of the corolla, are wholly included, the filaments being very short, smooth, somewhat arcuate, and inserted into the basal contraction of the tube; the anthers are four times the length of the filaments, linear, with two narrow cells, fixed along their whole length, upon a narrow dorsal connective which forms an extension of the filament; the cells burst by a longitudinal line in front, and also by an apical pore, for the external valves are there reflected on each side. The ovarium is small, obovate, superior, and fixed upon a somewhat two-lobed annular gland; the style is exerted beyond the mouth of the corolla, is smooth, somewhat subulate, and truncated at its apex by a small stigmatic pore. The matured fruit, in consequence of the apparently quick growth of the plant, is found only in the dichotomy of the branches, where the peduncle is from 2 to 3 lines long: the calyx is now become greatly enlarged, having acquired a globular form, 4 lines in diameter, very finely reticulated, and contracted in the mouth, which is closed by a very small five-toothed orifice; the included berry is globular, $2\frac{1}{2}$ lines in diameter, with a very thin membranaceous pericarp, apparently without pulp, and probably once filled with an aqueous juice; it is two-celled, and contains about fourteen seeds, which are of a large size compared with the smallness of the berry; these are flat, thin, nearly oval, reniform; the testa is scrobiculate and brittle; the horny and rather translucent albumen incloses a somewhat spiral filiform embryo, in which the radicle (at least three times the length of the cotyledon of equal diameter) points

towards the basal angle of the seed below the hilum, which is seen in the marginal sinus*.

LEUCOPHYLLUM.

This genus was first published and figured in the 'Plantæ Æquinoctiales,' and Bonpland in his observations upon it remarks, that although it appears to belong to *Scrophulariaceæ*, on account of its didynamous stamens, it bears in its habit more the aspect of the *Solanaceæ*, and from this circumstance, the specific name of *L. ambiguum* was evidently given to the species he described.

Professor Kunth, in his 'Nov. Gen. et Sp.' ii. p. 360, observes, that this genus may be considered as nearly allied to *Maurandia* and *Antirrhinum molle*, but I cannot perceive any such analogy. Dr. Lindley, in his 'Nat. Syst. Bot.' p. 292, placed this genus in *Scrophulariaceæ*, among the tribe *Veronicæ*, and Dr. Endlicher in his 'Gen. Plant.' follows this example; lastly, Mr. Bentham in his admirable monograph of this order arranges it in his tribe *Gratioleæ*, and his subtribe *Aptosimeæ* (DC. Prod. x. 344). After a careful examination of the structure of this genus, I have come to a very different conclusion, and hope to show, by good evidence, that its true place is near *Atropa* and *Lycium*, and therefore not among the *Scrophulariaceæ*. The structure of the corolla in *Leucophyllum* precisely corresponds with that of *Atropa*, having a campanulate tube, with a small border slightly oblique, of five nearly equal rounded lobes, which are imbricately disposed in æstivation, and five somewhat unequal stamens, two being always shorter; and it sometimes happens that the anthers of one of the three other stamens are abortive, or the fifth stamen altogether wanting; and such is the state, I conclude, of the species described by Bonpland, as I have noticed in Hartweg's specimen, although, in Galeotti's plant of *L. ambiguum*, I have found the flowers to be always pentandrous, as in *L. campanulatum*. All the species of *Leucophyllum* resemble *Lycium* in their fruticose habit, with solitary, axillary, violet-coloured flowers, and one species has an evident tendency to become spinous, like this last-mentioned genus. Had *Leucophyllum* possessed a baccate fruit, its position would unquestionably have been between *Atropa* and *Lycium*; but as it is capsular, it will fall into a new tribe, which may be called *Leucophylleæ*, that will stand between the *Hyoscyameæ* and *Atropeæ* (huj. op. iii. 166). The following is an outline of its generic features:—

LEUCOPHYLLUM, Bonpl. (char. reform.).—*Calyx* parvus, profunde 5-fidus, laciniis æqualibus, lanceolatis, erectis. *Corolla*

* A figure of this species and its analytical details will be given in plate 57 of the 'Illustr. South Amer. Plants.'

campanulata, tubo amplo infundibuliformi, limbo 5-fido, sub-bilabiato, lobis fere æqualibus, antico subminori reflexo, 2 posticis erectiusculis, omnibus oblongis, obtusis, æstivatione imbricatis. *Stamina* 5, inæqualia, inclusa, corollæ dimidio longitudine, 2 antica breviora, quinto interdum rudimentario, rarius omnino deficiente; *filamenta* imo tubi affixa, glabra, basi crassiuscula, apice subdeclinata; *antheræ* sagittato-bilobæ, lobis apice nexis, longitudinaliter intus dehiscentibus, quinti interdum minimæ, aut abortivæ. *Ovarium* oblongum, glandula annulari fere obsoleta imo cinctum, 2-loculare, *ovulis* plurimis, dissepimento medio prominulo et incrassato utrinque adnatis. *Stylus* erectus, filiformis, apice declinatus, longitudine staminum. *Stigma* breviter bilabiatum, lobis adpressis. *Capsula* ovata, coriacea, calyce persistente cincta, septicide dehiscens, valvulis apice 2-fidis, marginibus introflexis, imo basi columnæ subglobosæ placentiferæ adhærentibus. *Semina* plurima, minuta, transversa, oblonga, compressa, dorso plana, quadrato-angulata, longitudinaliter curvata, striato-rugulosa, hilo ventrali et fere basali. *Embryo* in *albumine* carnosio oblongus, curvatus, subcompressus, *cotyledonibus* oblongis, *radicula* basali tereti vix latioribus, et 2-plo longioribus.—Suffrutices *Mexicani*, *pube brachiato densissime tomentoso vestiti*; folia *alterna*, *subparva*, *crassa*, *uninervia*, *breviter petiolata*; flores *solitarii*, *axillares*, *folio subæquales*, *breviter pedunculati*, *corollæ tubo calyce 2-3-plo-ve longiore*.

1. *Leucophyllum ambiguum*, Humb., Bonpl. Pl. Æquin. ii. 95. tab. 109; H. B. K. ii. 361;—foliis ovatis, basi apiceque acutiusculis, utrinque densissime tomentosis, cinerascens, junioribus pallide incanis; laciniis calycinis lineari-lanceolatis, extus tomentosis, intus glabris, nitidis, 3-nerviis, corollæ tubo amplo 3-plo brevioribus; ovarii apice, stylique basi pilosis.—Mexico. Actopan, Prov. Mexico, alt. 6600 ped., *Bonpland*. Atotonilco el Grande, Prov. Durango, *Hartweg*, n. 357. Zimapan, *Galeotti*, n. 7210.

This is described by Bonpland as a tall shrub, 8 to 15 feet in height, with a stem slightly tortuous, 4 or 6 inches in diameter, covered with a slightly rent bark. It is a very conspicuous object in the forests, showing itself at a distance by its silvery leaves, and forming a striking contrast with the dark green foliage of the surrounding trees. Its leaves are from $\frac{1}{2}$ to $\frac{3}{4}$ inch long, 5 or 6 lines broad, with a petiole 2 lines in length; its calyx measures 2 or 3 lines, and is smooth within; its violet-coloured corolla is $\frac{1}{2}$ an inch long, smooth outside and pilose within. This species may readily be distinguished from the others, by its leaves being acute at both ends; in the older ones the tomentum is of a

blackish gray, in the younger leaves of a pale yellowish white; the small branchlets are 4 to 8 inches long, almost bare, prominently knotty at the articulation of the fallen petioles, with only a few leaves towards the extremity, and with solitary flowers in their axils. Bonpland describes the stamens to be didynamous, quite glabrous, and the upper lobe of the corolla woolly within, and the tube pilose inside to the insertion of the stamens. Kunth, who probably examined very imperfect specimens, says, on the contrary, that it is quite smooth within, and that it has a convex palate marked with orange-coloured glandular spots, but I can perceive no indication of such a palate. In the above-mentioned specimens, the calycine segments are smooth within; the corolla is also smooth, and hairy only in the mouth and upon the lobes of the border. Galeotti's specimen, as I have before observed, has distinctly five fertile stamens, Hartweg's has only four.

2. *Leucophyllum Texanum*, Benth., DC. Prodr. x. 344;—ramis glabris, tortuosis, nodosis, subspinescentibus, junioribus tomentosis; foliis obovato-oblongis, apice rotundatis, utrinque cano-tomentosis; calyce extus tomentoso, laciniis lato-lanceolatis, intus pubescentibus et 3-nerviis; corolla præcedentis, staminibus 4 didynamis, cum quinti rudimento, filamentis complanatis, lævibus: capsula apice pilosa.—Mexico, Prov. Texana, *v. s. in herb. Hook. (Laredo, Berlandier.)*

In this species the branchlets are more glabrous, more tortuous, and more knotty at the axils of the fallen leaves, often spinous at the short abortive branchlets, the leaves more obovate-oblong and rounded at the apex, the younger leaves incanous, not ferruginous, the calycine segments more oblong and broader; the leaves are 7 or 8 lines long, 4 or 5 lines broad, the petiole being scarcely appreciable; the calyx is $1\frac{1}{2}$ line in length; the corolla, including the lobes of the border, is $\frac{1}{2}$ inch long: the calyx, though persistent, does not increase in size in fruit; the capsule is small, ovate, $1\frac{1}{2}$ line long, the two valves being inflected at the margin, very thick and coriaceous, and bifid nearly to the base.

3. *Leucophyllum campanulatum* (n. sp.) ;—ramis substrictis, ramulis abbreviatis, approximatis; foliis ovato-orbicularibus, crassis, utrinque densissime tomentosis, adultis incanis, junioribus confertissimis, ferrugineis; floribus axillaribus ideo arctis, folio superantibus, calycis laciniis crassis, lanceolatis, apice obtusiusculis; corolla præcedentibus dimidio majore, glabra, intus simpliciter hirta, ovarii apice, stylique basi, dense pilosis.—Mexico, *v. s. in herb. Lindl. et Hook. (Zimapan, Prov. Mex., Coulter, n. 1271).*

This species is very distinct from the two former, its leaves

being more orbicular, 8 lines long, 7 lines broad, on a channeled petiole 2 lines in length, the older ones being always incanovelutinous, the younger of a deep ochreous colour; the branchlets are very much crowded, and not longer than 1 or 2 inches; the axils much closer, with more copious foliage, hence the flowers appear densely crowded: the corolla is of a deep violet-blue, 7 or 8 lines in length, broader in proportion; its border is somewhat oblique, with five rounded lobes, the anterior one more reflected, the two posterior lobes more erect; it is nearly smooth outside, and very pilose within. Another characteristic feature is, that the upper moiety of the ovary, and the lower portion of the style, are densely covered with white hairs, the basal gland being smooth; it has constantly five stamens, of which the three anterior are somewhat shorter. The hairs of the corolla and pistillum are simple and articulated, those of the calyx stellately plumose, as in the rest of the plant*.

XXIV.—*Heights of some points of the Cotswold Hills, with some experiments with the Aneroid Barometer.* By W. HENRY HYETT, Esq., F.R.S.†

A FEW months ago, in a formal Report, an Inspector under the Board of Health stated that "Cheltenham has been estimated to stand 200 ft. above the level of the sea, and the height of the Cotswold Hills above the same level is about 300 ft.:"—he meant probably to say "above the level of Cheltenham;" thus making the absolute height of these hills 500 feet above the sea—still an estimate rather wide of the mark when given under the nose of Cleeve Cloud, which exceeds 1000.

It is true the case required no accuracy, but such a degree of inaccuracy could scarcely have appeared had a more general knowledge of the truth prevailed in this part of the country. Indeed it has been for years matter of complaint that even the relative heights of the several remarkable points of our Cotswolds were unknown—Painswick, Birdlip, Leckhampton and Cleeve Cloud each having their respective champions, but with no authority to quote, nor umpire to determine between them.

Having consulted some of the scientific Members of the Cotswold Club on the point without success, I ventured to suggest that they at least should try to set it at rest. The coincidence of the present Ordnance Survey for the improvement of the river Severn, having their signal staffs actually standing on the very

* A drawing of this plant with sectional details will be shown in plate 58 of the 'Illustr. South Amer. Plants.'

† Read to the Cotswold Nat. Hist. Club, Sept. 27, 1849.

eminences in question, offered an opportunity not to be lost of having measurements made.

I therefore proposed to our excellent President to get (as best I could) a list of the heights of those hills from which we derive our name, and which in the course of our excursions we so frequently climb;—a subject of peculiar interest therefore to ourselves, and not without importance to all who study the geology, botany, &c. of this range. Immediately on receiving his concurrence I wrote to Capt. Yolland, R.E., who has the mapping department of the Ordnance under his direction, and the command of the parties now executing the survey of the Severn. Observing that the signal staffs of their present Trigonometrical Survey afforded the easy means of taking the vertical as well as the horizontal angles, and of acquiring all the information which the public needed, I ventured to express a hope to that officer that he would afford it.

In reply he promised to communicate the information requested, and has since most obligingly supplied the approximate heights above the mean level of the sea of sixteen remarkable points in our vicinity which I shall presently read to you, together with other data which I have myself obtained by the aid of the aneroid barometer lately invented in France, and much vaunted as applicable to the measurements of heights. I then procured one of these instruments from Dent, with his pamphlet upon it, and will now give the results of its comparison with the measurements received from Capt. Yolland.

It may be as well however first to make a few remarks on this new instrument, with a view to show how far it may be applicable in its present state to the purpose of measuring altitudes. It is probably known to most of you, that in carrying a mercurial barometer to the top of a high mountain, the mercury sinks from two causes, the one purely barometric, the other thermometric. Whilst for every 850 feet of perpendicular ascent the weight of the air decreases so as to show a fall, in its counterpoise the quicksilver, of about an inch—for every 300 feet of ascent there is also a decrease in the temperature of 1° Fahrenheit, occasioning a proportional contraction in the quicksilver in the tube, making it stand so much lower than it ought to do were its descent due to the diminished pressure of the air alone. To calculate therefore correctly the height indicated by the mercurial barometer, allowance is always made for decreasing temperature, and tables have been compiled for this purpose from the known rate at which mercury contracts by cold.

The same double effect is doubtless produced in the aneroid barometer, which Mr. Dent says is compensated by means of gas

in the "vacuum-vase" of the instrument. This however is, I believe, a mistake*.

In its present form, then, I conclude that a correction for temperature is needed for the exact measurement of heights. There are also two palpable defects, one of which is that the hand or index is frequently so far from the face of the dial, that its parallax leads to error in reading off the scale, which may easily amount to 20 feet in height. This however may be somewhat corrected by bending the hand so as to make it nearly touch the face of the dial. The other fault is that the inch is subdivided into only forty parts, one of which corresponds to 22 feet in height. It would be better to have it graduated to hundredths—so that the actual reading off should tally at once with the barometric tables now in use—or if the size of the dial will not admit of this, to subdivide the inch into fifty instead of forty parts, so that each division should be $\cdot 02$ of an inch. At present, in order to use the tables, it is necessary in reading off to change the vulgar fractions into decimals, which, in jotting down, frequently leads to troublesome mistakes.

It is full time however to come to the table which I promised of the

*Approximate altitudes above the mean level of the Sea supplied
by Capt. Yolland, R.E.*

	By Ordnance Survey. feet.	By Aneroid Barometer. feet.	Difference by Aneroid. feet.
Tewkesbury Church, surface of ground ...	47		
Gloucester Cathedral, surface of ground ...	56		
Barrow Hill, surface of ground	198		
Corse Hill	292		
Christ Church tower, Cheltenham (top)...	343		
Robin's Wood Hill	652	634·2	—17·8
Standish Hill.....	715	691·4	—23·6
Stinchcombe Hill	725	740·27	+15·27
Finger-post on top of Frocester Hill .....	.....	780	
Oxenton Hill.....	733		
Firs at Symond's Hall .....	.....	810	
Uley Hill	823	825·5	+2·5
Painswick Hill	929	935·9	+6·9
May Hill	966		
Birdlip Hill	969	960·5	—8·5
Leckhampton Hill	978	969·9	—8·1
Base of Bredon Hill tower	979		
Cleeve Hill or Cleeve Cloud	1081	1066·8	—14·2
Malvern	1396		

With the exception of Standish and Robin's Wood Hills, the

* I have since ascertained it to be one. M. Vidi himself informed me in November last, that although he at one time made some experiments on the use of gas in the "vacuum"—(qy.) "vase,"—he has now rejected it altogether.

height of each of which is the result of a single observation with the aneroid, the agreement of its indications with those of the Ordnance determinations is very remarkable, considering the errors to which the present construction of that instrument render it liable. I must observe, however, that they are brought nearer to the trigonometrical measurements by my having rejected some of my first attempts, in which I am almost certain that I made mistakes, and by subsequently adopting the mean of two or three observations, a process which always reduces the extremes of error. Thus for Painswick Hill I had three observations—

One giving it . . .	919 feet.
Another	934·8 „
The third	954 „

giving a mean result of 935·9 feet, which differs only 6·9 feet from Capt. Yolland's figures.

I am sorry that I have not had time to try more of our heights ; but I thought it better to repeat the observations on the same hills in order to obtain mean results, and thus to sift my own probable errors, than to persevere in them undetected.

Throwing out of consideration, then, some of my first trials, before I was quite up to the use of the instrument and its tables, the results which I have just given are highly satisfactory. But on the other hand I tried it against the published sections of the Cheltenham and Great Western Railway with less success, as the following comparison will show :—

	By Company's sections. feet.	By Aneroid. feet.	Error. feet.
Stroud station above Gloucester station	116·3	124·75	+8·45
Summit-level at top of Saperton tunnel above Gloucester	352·2	413·7	+61·5

Now these were the means of two trials ; in the latter case the discrepancy is greater than I can easily explain, unless the oscillations of the railway carriage have any effect on the instrument, which I can hardly suspect ; for in all other cases, however carefully carried, it must have been exposed to rough shaking*. On the whole therefore I must suspend my opinion as to the merits of the aneroid for measuring heights till after further experiments, and at any rate would recommend the improvements in the construction, to which I have before alluded, to be effected, viz. the decimal graduation to be adopted, and the index to be placed closer to the face of the instrument.

P.S. Since the compilation of the above paper I have been

* The error may be this—that the Company's sections were published before the completion of their line, which was eventually carried at a rather higher level than these sections show.

fortunate enough, on a visit to Paris, to make the acquaintance of the ingenious inventor of the aneroid—which I find, in its present state, he regards as a domestic rather than a scientific instrument,—an estimate of its capabilities in which its continued use leads me very much to concur. Still, while I find it perfectly well adapted to the house purposes of a common weather-glass, I can say no less of it as an instrument for taking heights, than that it is far more commodious and much less likely to get out of order than a mercurial barometer—and when limited, as my trials were, to heights not exceeding 1200 feet, that it exhibits quite sufficient accuracy for general purposes—a power which I have no doubt in its present form may be extended to heights of some 2500, and were the index graduated to 24 or 25 inches of the mercurial barometer, probably to the height of any hills in Great Britain.

M. Vidi, however, has made some elaborate trials towards a more purely scientific instrument. If he persevere, I have no doubt he will succeed.

The grand Exhibition of Works of Art in London in 1851, offers him a good opportunity for submitting his invention to more general notice,—and, to the judges perhaps, a not inappropriate object for a premium.—W. H. H.

XXV.—*On the Embryogeny of Hippuris vulgaris*. By JOHN SCOTT SANDERSON, F.B.S.E., Member of the Royal Medical Society of Edinburgh*.

THE subject of the origin and development of the embryo has been lately brought before botanical readers so frequently in the various journals appropriated to vegetable physiology, and so much has been done by so many observers in the elucidation of the subject, that it must appear somewhat uncalled for to occupy your time with facts and observations which are only repetitions of what has been much better detailed by others in regard to other species, and by which therefore these results can only be corroborated.

As however the observations referred to are contained in foreign journals, and may have escaped the notice of many members whose attention has not been directed to this particular branch of botanical science, I trust that the following details will not prove wholly unacceptable, more especially as they will enable me to lay before you some of those highly important generalizations, which are to be obtained from the splendid researches of Hofmeister, Unger, Tulasne, and others, on the subject of em-

* Read before the Botanical Society of Edinburgh, Feb. 14, 1850.

bryogeny. We shall see as we proceed, that we are now enabled to construct a morphological type of development complete in all its parts, and applicable to all the hitherto investigated orders of phanerogamous plants.

Hippuris vulgaris belongs to the natural order *Haloragaceæ*, which contains only three British genera, *Myriophyllum*, *Hippuris* and *Callitriche*, all the species of which are water-plants with floating and submerged leaves. They appear to be distinguished by their submerged leaves possessing distinct bundles of spiral vessels, a fact which may be well seen in the common *Callitriche verna*, and has been lately shown by Barnéoud in those curious plants the *Trapas* which float on the rivers of Southern Europe, and are considered by many botanists as belonging to this order.

The ovary of *Hippuris* is one-celled, containing a single pendulous ovule, attached nearly at its apex by a fleshy funiculus. In its earliest condition I have not had an opportunity of examining it. If however it be examined at a period considerably before that of impregnation and before the development of the solitary anther is completed, it is observed to have become completely anatropous. The nucleus lies loosely in the cavity formed by the envelopes, which completely surround it, attached to the chalaza. The envelope is not distinguishable into primine and secundine, and extends considerably beyond the apex. It consists of small hexagonal cells arranged in series, each containing a nucleus. On one side, the raphe, consisting of a bundle of imperfect spirals, is seen passing from the hilum to the chalaza.

The nucleus, the structure of which cannot be seen on account of the opacity of the envelopes without dissecting it out, consists of a large cell, the embryonic vesicle, extending from its apex to about two-thirds of its length, which is surrounded by a single layer of very transparent, gelatinous-looking nucleated cells, which are however deficient at the apex, at which point the embryo-sac seems to be totally uncovered.

Contained in this embryo-sac is seen the embryo-vesicle. This body consists of a single elongated cell attached to the free extremity of the embryo-sac. This cell (the embryo-vesicle) contains a granular protoplasm in which here and there globules are observed to float. It probably originates at a very early period from the micropyle-end of the embryo-sac, but I have not been able to trace it at any earlier stage than that represented. The form which it presents, of an elongated cell attached to the end of the embryo-sac next the micropyle, and smaller at its attached than at its free extremity, is prevalent throughout the *Scrophulariaceæ*, *Cruciferaæ*, and other orders.

From the fact that the embryo-vesicle is developed at so long a period before the bursting of the anther, little doubt can remain as to its existing prior to the act of impregnation, and not being, as supposed by Mirbel and Spach, a consequence of that act. Still less can it be supposed to be the end of the pollen-tube, according to the theory of Schleiden and his followers.

We now proceed to notice the changes which the embryo-vesicle undergoes subsequently to the act of impregnation. After impregnation, the granular protoplasm, which has accumulated at the larger extremity of the embryo-vesicle, becomes transformed into a spheroidal cell. A septum is then observable at the lower part, crossing it horizontally, by which it is divided into two cells. Of these the inferior is developed downwards by successive merismatic division, so as to form a confervoid filament, the suspensor. The upper assumes at the same time a spheroidal form, and is distinguished from the rest by being filled with granules, exactly as occurs in the *Orchidaceæ*. Soon after it divides by a longitudinal septum, and subsequently by a transverse. These are followed by successive divisions, and the embryo with its suspensor is formed. While these changes are taking place, the embryo-vesicle, which in the early stage is adherent by one of its extremities to the micropyle-end of the embryo-sac, becomes correspondingly enlarged and elongated. It however never becomes completely filled with the cells of the suspensor, or at least not until a very late period. It seems to be narrowed at its apex, either by the absorption of its contents by the developing embryo, or by the pressure of the contiguous parts. Subsequently the round mass of cells described above, to which the term *embryo-globule* has been applied, undergoes further development, and the cotyledons and other parts being gradually formed, the embryo assumes its characteristic appearance.

Thus we see in this plant—1st. That the embryo-vesicle exists at a period previous to the act of impregnation; 2nd. That after impregnation a number of cells are formed by an endogenous process in its cavity which assume a confervoid arrangement; 3rd. That of these one is selected to be developed into the embryo; 4th. That the rest undergo no further development, but seem to conduce to the nutrition of the embryo. These facts are in every respect conformable to what is known of the embryogenic process in the *Orchidaceæ*, *Onagraceæ*, *Scrophulariaceæ*, *Cruciferaæ*, and other natural orders.

Since the above observations were made, I have had the opportunity of seeing the results of two very important series of researches by Hofmeister of Leipzig and Tulasne. These researches lead to the conclusion, that the mode of development above de-

scribed in *Hippuris* is that which holds universally throughout phanerogamic plants. The results of Hofmeister, as detailed in his Monograph on the origin of the vegetable embryo, published at Leipzig last year, are as follows :—

A long time previous to the period of fecundation a certain number of free cellular nuclei are formed in the embryo-sac. These generally occur at the end of the sac next the micropyle. After this, free spherical cells are observed to be formed at the same part of the embryo-sac, which are usually three in number, an arrangement which probably depends on merely mechanical causes, and is well seen in the *Orchidaceæ*.

These cells are destined for the formation of the embryo itself, and are to be distinguished from those of a smaller size which are often observed at the same period at the opposite extremity of the embryo-sac, and conduce merely to the formation of the endosperm.

These cells are the embryo-vesicles, and from them the embryo is produced. One of them only remains active, while the rest abort. This being acted on by the fovilla at the period of fecundation, undergoes the development detailed below and becomes the embryo.

At the period of impregnation the pollen-tube arrives at the embryo-sac. Sometimes the sac-membrane is so firm as not to be indented by it. Sometimes it is considerably indented, and adherent for a longer or shorter period. At other times it appears, from its great tenuity, to be pierced by it. In all cases the embryo-vesicle remains perfectly closed, so that any communication between it and the end of the pollen-tube is impossible.

After impregnation the embryo-vesicle becomes divided into two cells by a transverse septum. These two cells are the first of those which form what Hofmeister calls the *pro-embryo*. The distal cell then in most cases divides by horizontal septa into a row of smaller cells. The terminal cell of this row then becomes more developed than the rest, and gives birth by an endogenous process to the embryo-globule. This then becomes developed into the embryo by the successive formation of new cells.

These results will be seen to harmonize perfectly with what has been already said with reference to *Hippuris*. They were obtained from the examination of a very great number of species belonging to various natural orders ; among which may be mentioned *Orchidaceæ*, *Gramineæ*, *Liliaceæ*, *Iridaceæ*, *Amaryllidaceæ*, *Polygonaceæ*, *Caryophyllaceæ*, *Ericaceæ*, *Geraniaceæ*, &c., and there is every reason to depend on their accuracy.

In the last two numbers of the 'Annales des Sciences Naturelles,' which have only appeared in the course of last week, M. L. R. Tulasne has published the most complete and beautiful

series of researches, as far as they go, among the many to which this controversy has given origin. The facts which are brought forward by this author are confirmatory in the most important particulars of what had previously been ascertained by Hofmeister, Unger, and others, but are distinguished by the author's inquiries having been carried to an earlier period in the development than had been arrived at by any previous observer in the families to which they refer, namely the *Scrophulariaceæ* and the *Cruciferaæ*.

In the *Scrophulariaceæ* generally, as in *Hippuris*, the embryo-vesicle assumes at an early period an elongated form, and its subsequent development is identical. Tulasne has traced it to its earliest origin in several species. He has shown that it is developed originally on the inner surface of the wall of the embryonal sac near its summit, but at a point quite separate from that at which the pollen-tube is applied. This vesicle, at first exceedingly minute, grows upwards in the cavity of the embryo-sac, until it assumes a form similar to that seen in *Hippuris*. These facts are important, as serving to point out more distinctly the strict correspondence between the morphological modifications of the same development as observed in the *Scrophulariaceæ* and other orders, with those possessed of distinct embryo-sacs, as the *Orchidaceæ*.

The researches before us also derive an additional interest from their showing the total inaccuracy of the observations of Prof. Wydler of Berne, (which were made on the same natural order,) who in the year 1838 set himself to support the theory of Schleiden, and from whose alleged facts that physiologist derived some of the most powerful supports of his views.

In the *Cruciferaæ* M. Tulasne has also accomplished all that can be done to perfect our knowledge of the embryogeny of the order. In particular he has described and figured distinctly the embryonal sac, the existence of which was doubted in that order, and has traced the embryonal vesicle from its earliest condition, that of a minute cellule attached to the micropyle extremity of the embryo-sac, up to that of a cylindriform cell filled with a granular protoplasm, at the period at which it should seem that fertilization takes place.

Numerous other points of great importance might be mentioned as illustrated by this admirable series of researches. They will well reward the perusal of all who take any interest in vegetable anatomy and physiology, and they are illustrated by drawings, which exceed in beauty and detail all their predecessors, although many of these have been beyond all praise.

From the accurate knowledge of the facts connected with the origin and development of the vegetable embryo, into the pos-

session of which the researches of Unger, Hofmeister, and Tulasne have put us, we need be at no loss to arrive at certain general conclusions as to the order in which the various steps of the embryogenic process are brought about, and the laws by which it is governed. We shall therefore occupy the remainder of this paper in enumerating as shortly as possible the most important of these generalizations.

In order to facilitate description, we shall divide what seem to be the essential phenomena of the embryogenic process in the higher plants into three classes, in the first of which we shall consider the process of development of the embryo-sac; in the second the changes which take place within the embryo-sac before, and in the third, after the act of impregnation.

We shall first speak of the development of the embryo-sac, or the individualization of a cell of the female organ for reproductive purposes.

At a very early period a constituent cell, of what is called in descriptive language by a singular misnomer the *placenta*, gives rise by successive division to a cylindrical body, which consists of a central series of cells surrounded by others of smaller size. This, by another equally obvious misnomer, is called the *ovule*. From the central series of cells just mentioned one is separated and set apart for reproductive purposes, while the rest are variously developed so as to form coverings to this one. It enlarges at the expense of the rest, and receives the name of embryonal sac, and is strictly analogous to the animal unimpregnated ovum.

We next consider the changes which take place in the cavity of the embryo-sac previous to impregnation.

At a period considerably prior to impregnation a vesicle is developed, always at the micropyle-end of the embryo-sac, and probably always from a cytotblast. This vesicle enlarges more or less, and contains a fluid granular protoplasm. To this the name embryo-vesicle is assigned. It is analogous to the germ-vesicle in animals, both in its production and subsequent development.

Besides the embryo-vesicle other cells are frequently developed at this period, which are destined to conduce to the nutrition of the future embryo.

Lastly, we have to consider the changes which take place in the embryo-sac after impregnation.

At this period a cell belonging to the male organ (the pollen-grain) becomes so developed that its membrane and that of the embryo-sac are brought in contact; in consequence of which an interchange of their contents takes place, and under the peculiar influence of the one upon the other, the embryo-vesicle begins to develop within it two cells divided from each other by a transverse septum, in the same way as the first change ob-

served after animal impregnation is the development of two cells in the germ-vesicle. These cells then multiply to a greater or less extent by transverse division so as to form a confervoid filament. At last, either at the centre or termination of this filament, one cell becomes developed by an endogenous mode of cell-production into a body to which the term embryo-globule is applied, and which is in fact the future embryo, while the rest perform a subordinate function, being probably merely subservient to the nutrition of the embryo. This last process corresponds in animals to the successive divisions of the two cells previously referred to, what is called the "*cleaving of the yolk mass*," on the surface of which the embryo is subsequently developed.

The foregoing sketch of what may be considered as the morphological type of the embryogenic development in the higher plants will, it is believed, include all those modifications which occur in those families which have been hitherto investigated. And considering that of late years, since the means of research have been so much more complete than formerly, there has been such a remarkable consonance in the results obtained by different observers, there is little reason to apprehend that any new facts are likely to arise, which will render it necessary to modify our generalizations to any great degree. We may therefore consider the controversy for the present settled. The doctrine of Schleiden is now only a matter of history, and as such possesses very great interest. When in 1837 he first brought forward his splendid discoveries as to the previously unknown nature and functions of cells, he founded upon them another doctrine, according to which the existence of sexes in plants was denied, and the so-called male organ alone was supposed to originate the germ. The history of this celebrated doctrine exemplifies in a remarkable manner the truth of the observation, that, although false facts may do an infinity of mischief in science, false theories are often productive of the greatest benefit.

The numerous researches which have been set on foot within the last ten years with a view to the refutation of the doctrines of Schleiden, have not only established the utter baselessness of these last, but have furnished us with a series of details more complete and more conclusive than any which we possess in connection with any other subject in the whole range of vegetable anatomy.

XXVI.—Notice of some of the rarer Plants observed in Orkney during the Summer of 1849. By JOHN T. SYME, Esq.*

HAVING passed the greater part of last summer in Orkney, and during that time having examined the natural history of the parts of it which I visited, I now lay before the Society a notice of a few of the rarer plants which I observed. I would have drawn up a list of *all* the species which I met with, but as I had opportunities of botanizing only in the southern part of the mainland and in the islands of Hoy, Burray and Flota, I have thought it advisable to defer this until I shall have made some acquaintance with the botany of the other islands, which I hope to accomplish next summer.

The flora of Orkney is by no means extensive, and excepting some alpine plants which are found at a lower elevation than usual, it embraces very few species of interest;—as is to be expected from its bare and treeless condition and the uniformity of its geological formation; the old red sandstone, with here and there a trap-dyke, being the only rock to be met with; while the incessant winds charged with saline particles and the low summer temperature forbid the growth of the more tender plants, as well as those which rise above the shelter of the surrounding vegetation.

In addition to these adverse circumstances, by far the greater proportion of the ground is flat and moorish, which still more contributes to give a sameness to the vegetation; so that I think we may account for the paucity of species from the physical conditions of the Orkney islands, without having recourse to any theory of centres of vegetation and migration of plants.

I shall now proceed to give the names of the plants I met with, nearly in the order in which I noticed them, with the dates when the various trips were made, as extracted from my journal.

On the 5th of June last, I went on board the screw steamer "Northman," at Leith, and after a tedious passage of forty hours, arrived in Kirkwall Bay. The morning was wet and windy, but being impatient to examine the botany and entomology of a district new to me, and feeling the desire of again walking on *terra firma*, as is natural to a landsman after a sea voyage of longer duration than he is accustomed to, I set out for Swanbister, the place of my destination, about eight miles south-west of Kirkwall. I soon found, however, that novelties or even rarities were not to be expected, for I did not in the whole of my walk find a single plant worth drying.

In the town of Kirkwall I saw *Stachys ambigua* (not yet in

* Read before the Botanical Society of Edinburgh, Feb. 14, 1850.

flower), growing among the nettles at the sides of the lanes. About two miles from Kirkwall there is a pond and marsh at the side of the road, where *Menyanthes trifoliata* was growing along with *Equisetum limosum* and *Carex ampullacea*; and in the moors along the sides of the roads, I saw *Luzula multiflora*, *Lycopodium Selago*, *Salix repens* and *Primula acaulis*, but nothing of any interest until I reached Swanbister, where *Scilla verna* was in great profusion, and *Gymnadenia albida* just coming into flower.

A few days after I found at Smoogro a curious variety of *Plantago lanceolata*, with very woolly leaves, lying flat on the ground and much broader than usual. Near this place *Stenhammaria maritima* used to occur, but there was no appearance of it. I suppose it must have been covered up with shingle by the sea, during the winter.

On the 12th of June I went to Howton Head, about three miles west of Swanbister, to see the station for *Primula scotica*, which was easily found, but appeared to have flowered very sparingly, as I only saw two plants in seed. Here I also found *Lycopodium selaginoides* and *Thalictrum alpinum*, about 200 feet above the sea; a curious fact, as where alpine plants are found at so low a level, it is usually where there is high ground behind, from which they have been brought down by burns, &c.; but here there are no hills of any considerable height near, and, indeed, I never found this nor any alpine plant elsewhere on the mainland.

On the 25th of June I had an excursion, in company with Mr. Robert Heddel, to Kirbister Loch, about two miles north-west of Swanbister. Here we found *Potamogeton filiformis*, 4 or 5 feet long, and with the peduncles 18 inches long (a form which I afterwards observed in the lower Loch of Stennis growing in the brackish water along with dwarfed and discoloured plants of *Fucus vesiculosus*).

In old marl-pits in the loch we found *Zannichellia palustris* and *Potamogeton heterophyllus* and *P. perfoliatus*. After completing the survey of the loch we went to Neversdale, where Dr. Duguid used to find *Ajuga pyramidalis* abundantly, but which had disappeared for the last four years; and after a very careful search, Mr. R. Heddel found a single plant of it, of which of course the root was carefully left. Here we also saw *Eleocharis uniglumis*, *Melampyrum pratense* β . *montanum*, and *Botrychium Lunaria*. But by far the most interesting excursion I made was to the Wast hill of Hoy, on the 28th of June, which I owed to the kindness of Mr. Heddel, who took me across in his yacht and pointed out the habitats of most of the very interesting alpine plants which are to be found there. Unfortunately our time

was very limited, as we had to beat against wind and tide, and so did not reach the Bow (at the foot of the hill) till the afternoon. The ascent to the hill is at first not quite so steep as the slope of the debris of Salisbury Crags at Edinburgh, and here *Galium pusillum*, *Saxifraga aizoides* and *Silene acaulis* were abundant, even at the very foot of the hill. After ascending about 500 feet, the red sandstone rock rises nearly perpendicularly for about 150 feet, and here we gathered *Thalictrum alpinum*, *Saussurea alpina*, *Oxyria reniformis*, *Sedum Rhodiola*, and a *Hieracium* not in flower, which appeared to be *H. murorum* γ. *Lawsoni*. Above the rocks the hill is nearly bare of vegetation, and covered with debris, among which *Dryas octopetala* was growing in great perfection. *Saxifraga oppositifolia* and *Draba incana* also occur on the hill, but we had not time to look for them, as I was most anxious to see the station for *Ajuga pyramidalis*, found by Mr. Robert Heddel, at the Burn of Berridale. We accordingly descended into the valley of Rackwick, gathering *Lycopodium annotinum* on our way, and reached the Burn of Berridale about six o'clock in the evening. This ravine is remarkable as being the only place in Orkney where the birch and mountain-ash are to be seen growing wild. We soon found the *Ajuga pyramidalis*, which is confined to the west side of the burn near its mouth, and is by no means easily noticed. The barren plants resemble very much young plants of *Digitalis purpurea*, and they usually flower under the shelter of bushes of *Calluna vulgaris*. The plants were small, from 1–3 inches high, but were still in flower, while that which I had seen in Neversdale some days before had its seeds nearly ripe. *Melampyrum pratense* β. *montanum*, *Scirpus fluitans* and *Drosera anglica* also occurred here, and *Arctostaphylos Uva-ursi* in great profusion. There are also bushes of *Corylus Avellana* and *Hedera Helix* among the rocks. *Rubus suberectus* was found by Dr. Duguid on the north-west of Hoy, but we had not time to visit the station before embarking on our return to the Bow.

My next trip to Hoy was on the 3rd of July, when I examined part of the south-west coast, in company with Mr. Heddel. About two miles from Melsetter, *Stenhammaria maritima* occurred, and on the hills in several places *Arctostaphylos alpina* and *Vaccinium uliginosum*. Mr. Heddel has found *Lobelia Dortmanna* in several of the lakes in Waas, but I did not meet with it myself.

On the 17th of August I again visited Howton Head, but found *Primula scotica* out of flower. I was misled by the plants of it in the garden at Swanbister, which came into flower at this time, being probably delayed in flowering by having been transplanted in the spring. *Anagallis tenella* and *Habenaria viridis*

were now in flower at this place, but I saw nothing else of any interest.

On the 28th of August I paid a visit to the north-west coast of Hoy, and found *Drosera anglica* in abundance, and *Vaccinium uliginosum* sparingly, and in the marshes above Rysay *Schaenus nigricans* and *Eleocharis multicaulis*, both of which I also found in several places in the mainland.

On the 31st *Stachys ambigua* was in flower at Kirkwall. Near Piggar, and in several other places round Swanbister, *Anthemis nobilis* occurs in plenty and apparently wild in one marshy field in particular, where it covers a large extent of ground, and is now at all events perfectly naturalized.

At Swanbister there is a tract of low land called the "Fidge," which used to be overflowed by the sea at spring tides, but is now protected from this by a sea-wall built by Mr. Fortescue. Here there are a good many of the plants that are to be found in salt marshes, *Salicornia herbacea*, *Cakile maritima*, *Alsine maritima*, *Sagina maritima*, *Carex extensa*, *Eleocharis uniglumis*, *Ruppia rostellata*, *Potamogeton filiformis*, *Blysmus rufus*, and one plant of *Stenhammaria maritima*. On the rocks called "Barnory," to the south of this, *Ligusticum scoticum* and the maritime form of *Pyrethrum inodorum* were seen; both of these plants also occur in profusion in the island of Burray along with *Silene maritima*.

Avena fatua and *strigosa* are found in most of the turnip-fields, &c., and appear to be quite indigenous. *Festuca ovina* var. *vivipara* is also common, and *Radiola millegrana* is to be seen in most of the moors.

There are a few bushes of *Populus tremula* and *Rosa villosa* on the cliffs, on the east side of the Wauk-mill bay between Kirkwall and Swanbister.

These are all the plants which I met with that are worth noticing; but on my next trip to Orkney I hope to be able to visit the north isles, which may perhaps add some others to the list, and make a trip to Orkney of sufficient interest to attract botanists more competent than myself to examine its flora.

84 Great King Street, Edinburgh, Feb. 5th, 1850.

XXVII.—*Descriptions of Aphides*. By FRANCIS WALKER, F.L.S.

[Continued from p. 28.]

77. *Aphis Mali*, Fabricius.

Aphis Mali, Fabr. Ent. Syst. iv. 216; Syst. Rhyn. 298; Schrank, Faun. Boic. ii. 116; Götze, Ent. Beit. ii. 317; Stew.

El. ii. 111 ; Turt. ii. 706 ; Shaw, Gen. Zool. vi. pl. 58 ; Kalt. Mon. Pflanz. i. 72. 52.

A. Pomi, Deg. Ins. iii. 36. pl. 3. fig. 18-21 ; Latr. Gen. Cr. iii. 173.

A. Oxyacanthæ, Schrank, Faun. Boic. ii. 116. 1219.

Oxyacanthaphis, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 478.

This species feeds on *Pyrus malus*, *P. communis*, *Cydonia vulgaris*, *Mespilus germanica*, *Sorbus aucuparia*, and *Cratægus oxyacantha*.

When very young, and in the middle of March, it has a dark green colour : the head and the limbs are still darker : the eyes are dark brown : the feelers are half the length of the body : the mouth reaches to the hind-hips : a dark stripe runs along each side of the body : the nectaries are about one-eighth of its length : the legs are rather short and stout : it dwells on the buds with the pale orange young ones of *Psylla Pyri*. When full-grown it is green, shining, oval, and convex : the limbs are brownish green : the feelers are setaceous, rather stout, brown, pale green at the base, and less than half the length of the body : the legs are pale green ; the feet are brown : the front is broad and convex, and there are no tubercles at the base of the feelers ; the first and the second joints of the latter are not angular ; the fourth joint is much shorter than the third ; the fifth is a little shorter than the fourth ; the sixth is a little shorter than the fifth ; the seventh is slender, and rather shorter than the third.

1st var. The body is pale yellowish green with three vivid green stripes.

2nd var. The body is grass-green, varied with yellow towards the head : the limbs are pale yellow : the feelers are one-third of the length of the body : the nectaries are one-twelfth of the length of the body.

3rd var. The body is green ; the limbs excepting the tips of the feelers are paler.

4th var. The body is green : the feelers are pale green, and very much shorter than the body : the nectaries are green, and from one-fourth to one-fifth of the length of the body : the mouth is green ; its tip and the eyes are black : the legs are pale green with brown feet.

5th var. The feelers are shorter than the body, and the nectaries equal one-tenth of its length.

6th var. The body is pale green : the feelers are pale brown, pale green at the base, and rather more than half the length of the body : the eyes are dark brown ; the mouth is pale green with a darker tip : the nectaries are less than one-twelfth of the length of the body : the legs are pale green, and rather short ; the feet and the tips of the shanks are brown.

The viviparous winged female. This as a pupa and when very young is reddish green, but afterwards acquires a rose or pale red colour: the nectaries are as long as one-eighth of the body: the rudimentary wings are pale red; they are unfolded before the middle of May, and then the insect is deep black: the hind-border of the fore-chest is dark green: the abdomen is green, and sometimes it has a row of black spots on each side: the feelers are black, dull green at the base, and much shorter than the body; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is a little shorter than the fifth; the seventh is quite as long as the third: the mouth is green; its tip and the eyes are black: the nectaries are black, and vary in length from one-sixth to one-tenth of the body: the legs are dull yellow; the feet and the tips of the thighs and of the shanks are black: the wings are colourless and nearly twice the length of the body; the wing-ribs are green; the wing-brands are pale brown; the veins are dark brown: the second fork is very short.

1st var. Black: the front and the back of the fore-chest, the fore-breast, and the abdomen are dark green: the feelers are a little shorter than the body: the mouth is pale dull yellow with a black tip: the fore-thighs, the shanks except their tips, and the four hinder thighs towards the base are yellow: the wing-ribs and the rib-veins are pale yellow; the wing-brands are pale brown; the other veins are brown.

2nd var. Green: the head, the disc of the chest, and that of the breast are black, and there is a row of black spots on each side of the abdomen: the feelers are black, and about half the length of the body: the nectaries are about one-twelfth of the length of the body: the legs are black; the shanks except their tips, and the thighs towards the base, and sometimes nearly the whole of the fore-thighs are pale yellow: the wing-ribs are sometimes pale yellow, and the colour of the wing-brands varies from pale brown to dull green.

3rd var. The fore-thighs are black with the exception of the base.

4th var. The body is grass-green: the discs of the head, of the chest and of the breast are pale reddish brown: the feelers are brown, and shorter than the body: the mouth is pale green with a brown tip: the eyes are dark brown: the nectaries are pale green, and about one-sixth of the length of the body: the legs are dull pale green; the feet and the tips of the shanks are brown: the wing-ribs and the rib-veins are dull green; the brands and the other veins are brown. On the whitethorn in the middle of May.

5th var. While a pupa it is green, with two darker green

stripes : the feelers and the legs are pale green ; the tips of the former and the feet are brown. When the wings are unfolded the insect is black : the borders and the underside of the fore-chest and the abdomen are green : the feelers and the eyes are black : the mouth is green with a black tip : the nectaries are black, and as long as one-tenth of the body : the legs are pale yellow ; the feet and the tips of the thighs and of the shanks are black : the wing-ribs are pale yellow, the brands are pale brown. On the whitethorn in the middle of June.

6th var. The body is dull green : the head and the disc of the chest are varied with black : the feelers are brown, green at the base, and shorter than the body : the wing-ribs are pale green ; the veins are brown.

7th var. While a pupa it is pale greenish yellow, with three vivid green stripes on the back : the feelers are pale yellow with brown tips and much shorter than the body : the mouth and the nectaries are pale yellow with brown tips, and the latter are nearly one-sixth of the length of the body : the legs are pale yellow ; the feet are brown. The winged Aphis is black : the abdomen is green : the feelers are rather short : the nectaries are black : the legs are pale green ; the feet and the tips of the thighs are black : the wing-veins are pale dull green.

The fourth branch vein of the wing has a more gentle curve than that of many species, and the angle whence it springs is slight ; the third as usual is obsolete at its source, and it runs nearly half its length before it sends forth its first fork, and more than three-fourths of the same before it sends forth its second ; the second vein diverges slightly from the third as it proceeds to the hind-border ; they are nearer to each other at their source than the third is to the fourth ; the third converges gradually towards the fourth from the base to the tip ; the first and second are nearer to each other at their source than are the second and third, but more remote at their tips.

Variations in the wing-veins.—1st var. The second fork is wanting.

2nd var. Both forks are wanting.

3rd var. Like the last, but the second and the third veins meet, and after a short space part, and proceed to their respective destinations.

4th var. The second fork in one wing is moderately long, in the other it is very short.

The oviparous wingless female. It appears in the middle of the autumn, and when very young it is pale yellow or greenish yellow : the tips of the feelers, the eyes, the tip of the mouth, and the feet are dark. When a little older it is elliptical, and of a soft pale velvet-like yellow hue : the feelers are black, pale yellow

at the base, and rather more than half the length of the body ; the knees and the tips of the shanks are black. When still older it acquires a green tint, especially on the abdomen : the nectaries have black tips, and they are one-sixth, one-eighth or one-twelfth of the length of the body : when full-grown the body is green and spindle-shaped, and the abdomen is lengthened towards the tip : the hind-shanks are hardly thicker or darker than the others.

1st var. Dark green with a bluish black hue.

2nd var. Buff.

3rd var. Pale orange.

4th var. Pale red.

5th var. The body is pale yellowish green, whitish green beneath : the head is brownish : the feelers are about half the length of the body : the mouth is pale yellow ; its tip and the eyes are black : the nectaries are black, and about one-twelfth of the length of the body : the legs are yellow ; the knees, the feet, and the tips of the shanks are black.

The winged male. It pairs with the oviparous female at the end of October, and is black : the front and the rear of the fore-chest, the fore-breast and the abdomen are dull yellow ; the latter is slightly traversed by black bands : the feelers are very nearly as long as the body, and like those of the female are thick, with the exception of the last joint ; the fourth joint is about half the length of the third ; the fifth is very nearly as long as the fourth ; the sixth is a little shorter than the fifth ; the seventh is rather longer than the third : the mouth is dull yellow with a black tip : the nectaries are as long as one-sixth of the body : the legs are yellow ; the feet and the tips of the thighs and of the shanks are black : the wing-ribs are pale yellow ; the veins and the wing-brands are pale brown ; the second fork is sometimes wanting.

1st var. The mouth is black ; its base is dull yellow : the four hinder thighs are black, with the exception of the base.

2nd var. The thighs are black excepting the base.

Length of the body $\frac{1}{2}$ – $\frac{3}{4}$ line ; of the wings $1\frac{1}{2}$ – $2\frac{1}{4}$ lines.

In the beginning of November the winged female is still occupied with bringing forth young ones, while the oviparous female is laying eggs. The leaves of the mountain ash are sometimes crowded with this *Aphis* in the autumn, and the wind carries them away with their insect-load. The apple-trees sometimes put forth new blossoms soon after the middle of June, the earlier flowers having been much injured by this *Aphis* and by *Psylla Pyri*. Mr. Spence mentions that the abundance of *Aphis mali* caused the failure of the apple crops in Worcestershire, Devonshire, and Herefordshire, in 1838.

78. *Aphis Padi*, Linn.

Aphis Padi, Linn. Syst. Nat. ii. 734. 8; Faun. Suec. 981; Fabr. Ent. Syst. iv. 220. 50; Reaum. Ins. iii. pl. 23. fig. 9, 10; Schrank, Faun. Boic. ii. 115. 1216; Stew. El. ii. 110; Turt. ii. 708; Kalt. Mon. Pfl. i. 74. 53.

Padifex, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 477.

The viviparous wingless female. This *Aphis* feeds on *Prunus Padus*, is hatched before the middle of March, and is then dull green: the feelers are blackish green, and less than half the length of the body: the eyes are dark brown: the mouth is dull green with a darker tip, and reaches the hind-hips: there is a dull red spot on each side of the abdomen near the nectaries, which are almost black, and about one-tenth of the length of the body: the legs are blackish green. In April it becomes rather broad, oval and convex, increasing in breadth from the head till near the base of the nectaries; its colour is now pale green, or grass-green tinged with yellow; the red spot at the base of each nectary is larger than before; and it is quite filled with young ones, and even the fore-chest is occasionally occupied by these little embryos, which sometimes exceed thirty in number: the feelers are pale yellow with brown tips, and not more than one-fifth of the length of the body; the fourth joint is more than half the length of the third; the fifth is very nearly as long as the fourth; the sixth is more than half the length of the fifth; the seventh is more than twice the length of the sixth: the eyes are black: the forehead is prominent in the middle, and has a slight tubercle at the inner base of each feeler: the mouth is yellow with a brown tip, and reaches the middle-hips: the legs are yellow; the feet and the tips of the shanks are black; the four hinder shanks are slightly curved; the fore-legs are but little more than half the length of the hind-legs: the nectaries are yellow with brown tips, and about one-twentieth of the length of the body: there is a short tube at the tip of the abdomen. Before the end of April the mother of a colony gives birth to a progeny of young ones that are very unlike their parent, being much darker and of a blackish green colour, and covered with white powder which increases in quantity as they advance in age. The colour when the skin has been lately shed is sometimes pale orange or dull olive-green, with a pale green head and almost white limbs. Mr. Hardy has sent me this species from the neighbourhood of Berwick in July, but it disappears from the bird-cherry near London in the beginning of summer, when the foliage is often almost destroyed by it and by *Yponomeuta Padella*, and it does not return to that tree till the autumn.

1st var. The body is dark brownish green.

2nd var. The feelers are nearly one-fourth of the length of the body.

3rd var. The feelers are half the length of the body.

4th var. The feelers are three-fourths of the length of the body.

5th var. The nectaries are one-twelfth of the length of the body.

6th var. The fore-legs are longer than usual.

The viviparous winged female. The pupa is not only distinguished from the wingless insect by its structure, but also by its darker colour and by its greater activity: the feelers are brown, pale green at the base: the legs are pale green; the feet and the tips of the shanks are brown: the rudimentary wings are pale green. The wings are unfolded in May, and the insect is then pale olive-green; the limbs are still paler, and the wings are milk-white: it is afterwards black: the abdomen is brassy black above, very dark green and covered with white powder beneath: the feelers are much shorter than the body; the fourth joint is shorter than the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is more than twice the length of the sixth: the nectaries are as long as one-twelfth of the body: the legs are dull green; the feet, the tips of the thighs and of the shanks, and the whole of the hind-thighs are black: the wings are colourless, and very much longer than the body: the wing-ribs are almost white; the wing-brands are green; the veins are brown.

At least eight young ones may be seen in its body while it is yet a pupa: the feelers are a little shorter than the body; the fifth joint is much shorter than the fourth; the seventh is nearly thrice the length of the sixth: the fore-legs are only a little shorter than the hind-legs; the fore-shanks are slightly curved, and very much longer than those of the wingless female: the nectaries are about one-twelfth of the length of the body: the widening of the main vein into the wing-brand begins at about half the length of the wing; it is very gradual in its approach towards, and union with, the fore-border, which is rather convex towards the base of the wing: the brand is irregularly spindle-shaped, and the fourth branch-vein springs from the middle of its hind-border; the third branch-vein is, as usual, obsolete before its source from the main-vein; its first fork occurs soon after one-third of its length, and its second fork soon after five-sixths of its length.

1st var. The legs are black, with the exception of the yellow base of the fore-thighs.

2nd var. The wing-brands are pale brown.

3rd var. The second fork in the third vein of the fore-wing is wanting. The length of this second fork is often very variable in the same species, and even in opposite wings of the same *Aphis*.

Length of the body $\frac{5}{4}$ -1 line ; of the wings $2\frac{1}{2}$ -3 lines.

79. *Aphis Sorbi*, Kaltenbach.

Aphis Sorbi, Kalt. Mon. Pfl. i. 70. 51.

The viviparous wingless female. This species is hatched in the middle of March or somewhat later, and then begins to feed on the buds of the apple-trees : it is very small and of a dark green colour : the head, the limbs, and a stripe on each side of the body are still darker : the feelers are not more than half the length of the body : the eyes are dark brown : the mouth reaches the base of the hind-legs : the nectaries are about one-eighth of the length of the body : the legs are rather short and stout. When full-grown the body is nearly round, dark reddish brown, and thickly covered with white powder : the limbs are black : the front is nearly straight, but has three slight tubercles : the feelers are half the length of the body : the nectaries are about one-ninth of its length.

1st var. Dull green, short, and very plump : the feelers are brown, dull green at the base, and shorter than the body : the eyes are black : the mouth is dull green with a brown tip : the nectaries are black, and as long as one-tenth of the body : the legs are pale yellow, and rather long ; the feet, the tips of the shanks and of the four hinder thighs are black.

2nd var. Very dark green : the thighs are black with the exception of the base which is pale yellow : the nectaries are one-eighth of the length of the body.

3rd var. Nearly round, dull reddish green, paler beneath : the feelers are black, and nearly as long as the body : the tip of the mouth is black : the nectaries are as long as one-sixth of the body : the legs are gray, excepting the base of the fore-thighs which is dull yellow.

4th var. The feelers are hardly half the length of the body.

5th var. The young one has a large dull tawny spot at the base of each nectary.

6th var. Dark reddish brown : the limbs are black : the feelers are half the length of the body ; the nectaries are one-ninth of its length.

7th var. Pale orange.

8th var. Dark orange.

9th var. Pale green.

10th var. Pale buff, darker towards the tip of the abdomen.

11th var. Pale red, short-elliptic : the feelers are white with

black tips, and as long as the body : the mouth is white ; its tip and the eyes are black : the nectaries are also black, and as long as one-fifth of the body : the legs are white ; the feet and the tips of the shanks are black.

12th var. Dull green, plump, and nearly elliptic : the feelers are white with brown tips, and longer than the body : the eyes are black : the mouth is white with a brown tip : the nectaries are black, and as long as one-fifth of the body : the legs are dull white ; the knees and the tips of the shanks are black.

13th var. Dull green, oval, mottled with red at the tip of the abdomen : the feelers are pale brown, and nearly white towards the base : the mouth is dull green with a brown tip ; the nectaries are brown, and as long as one-fifth of the body ; the feet and the tips of the thighs and of the shanks are also brown.

14th var. Dull green, oval, more or less tinged with red, and covered with a white powder, or mottled with red and green, or all red, or varied with black ; there is a row of black spots on each side of the body : the feelers are black, pale yellow towards the base, and nearly as long as the body : the mouth is pale yellow ; its tip and the eyes are black : the nectaries are pale yellow with black tips, and nearly one-fourth of the length of the body : the legs are yellow ; the feet, the knees, and the tips of the shanks are black. On the mountain-ash.

The viviparous winged female. While a pupa it resembles the wingless female, but it is rather narrower, and its rudimentary wings are whitish ; these organs are unfolded in May, and the insect is then black and shining : the fore-chest is red, which colour also prevails on the base and the underside of the abdomen : the feelers are shorter than the body : the mouth is pale yellow with a black tip : the nectaries are as long as one-sixth of the body : the legs are pale yellow ; the thighs except the base, the feet and the tips of the shanks, are black : the wings are colourless, and longer than the body ; the wing-ribs are pale yellow ; the veins and the wing-brands are dull yellow ; the second fork is very long.

1st var. The fore-border and the hind-border of the fore-chest are green : the abdomen is dull yellowish green ; its disc is black, and there is a row of black spots on each side : the wing-brands and the veins are brown. On the mountain-ash.

This species feeds on *Cratægus oxyacantha*, *Pyrus malus*, *Sorbus aucuparia* and *S. domestica* ; it appeared in thick clusters on this last tree near London in the summer of 1847, and gave the leaves autumnal red and yellow tints, and great numbers of humble-bees (*Bombi*) came to feed on its honey.

The oviparous wingless female. This appears at the end of October ; it is oval, yellow, and rather flat, and has a distinct rim

on each side of the body : the feelers are black towards the tips, and much longer than the body : the eyes and the tip of the mouth are black : the nectaries have black tips, and are nearly one-fourth of the length of the body : the legs are pale yellow ; the knees and the tips of the shanks are black.

The winged male. This appears in the autumn and pairs with the oviparous female at the end of October : it is deep black : the abdomen is sometimes dark red with a black line along the middle ; it has a white bloom beneath : the feelers are slender, and much longer than the body ; the fourth joint is much shorter than the third, but more than half its length ; the fifth is shorter than the fourth ; the sixth is about half the length of the fifth ; the seventh is a little longer than the fourth : the nectaries are nearly one-fifth of the length of the body : the thighs towards the base, and the shanks except their tips are dark yellow : the wings are very much longer than the body ; the wing-ribs, the rib-veins and the wing-brands are pale brown ; the second vein diverges rather more from the first than it does from the third ; the first fork of the latter vein begins a little after one-third, and the second beyond two-thirds of its length ; the fourth vein is much curved near its base, but nearly straight towards its tip : the angle whence it springs is slight.

It sometimes couples also with the oviparous female of *Aphis Mali*.

Both these species very abundant in the autumn of 1846, but very scarce during that season in 1847.

Length of the body $\frac{3}{4}$ –1 line ; of the wings $2\frac{1}{2}$ –3 lines.

80. *Aphis Euonymi*.

Aphis Euonymi, Fabr. Syst. Ent. 736. 14 ; Ent. Syst. iv. 214. 21 ; Syst. Rhyn. 294. 21 ; Gmelin, Syst. Nat. i. 2206 ; Schrank, Faun. Boic. ii. 1. 108 ; Turt. ii. 705 ; Sir Oswald Mosley, Gard. Chron. i. 684 ; Kaltenbach, Mon. Pflanz. i. 79. 57.

Euonymaphis, Amyot, Ann. Soc. Ent. Fr. 2 série, v. 478.

The viviparous wingless female. This appears on the spindle-tree (*Euonymus europæus*) in April : it is black, oval, convex, short, broad, very plump, and covered with a white bloom : the feelers are white, and about one-third of the length of the body ; their tips are black : the nectaries are about one-fifteenth of the length of the body : the legs are rather short, the shanks are white with black tips ; the fore-shanks are dirty white with brown tips. The young one is like its mother, but more flat and linear, less intensely black, and without bloom ; its limbs are blackish green, and at the moment of its birth its body is dark green. The front of the head is slightly convex, and not notched ; the first and the second joints of the feelers are not angular ; the

fourth joint is shorter than the third; the fifth is a little shorter than the fourth; the sixth is a little shorter than the fifth; the seventh is nearly twice the length of the sixth.

1st var. Dark bronze colour.

2nd var. Pale whitish green; limbs darker.

3rd var. Black and white, or piebald.

4th var. Dark velvet-like red: the feelers are white with black tips: the mouth also is white; its tip, the eyes and the nectaries are black: there is a large and somewhat pale spot on the disc of the body: the legs are white; the four hinder thighs, the fore-knees, the feet and the tips of the shanks are black. When very young it is pale red, and its legs excepting the feet are nearly all white.

It is infested by an *Aphidius*. The clusters of dead bodies which stick to the leaves are consumed by little *Acari*.

The viviparous winged female. While a pupa it has spots of white powder in a row on each side of the body: when the wings are unfolded it is stout, thick, black, shining, and has a slight metallic tinge: the feelers are more than half the length of the body; the fourth joint is shorter than the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is hardly twice the length of the sixth: the mouth is dull green with a black tip: the nectaries are not more than one-tenth of the length of the body: the legs are black; the shanks except their tips, the base of the thighs, and nearly the whole of the fore-thighs, are yellow: the wings are colourless, and are very much longer than the body; the wing-ribs and the rib-veins are pale yellow; the wing-brands are dull buff; the other veins are brown; the second vein diverges much more from the first than it does from the third; the first fork of the latter vein begins after one-third, and the second still more beyond two-thirds of its length; the fourth vein is more curved at its source than near its tip: the angle whence it springs is very slight.

1st var. Pale whitish green with dark limbs.

2nd var. Body black and white.

3rd var. Wings with a slight yellow tinge.

4th var. Body small, black: abdomen dark green: the seventh joint of the feelers is more than twice the length of the sixth.

Length of the body $\frac{1}{2}$ – $\frac{5}{8}$ line; of the wings $1\frac{3}{4}$ – $2\frac{1}{4}$ lines.

Variations in the veins of the wings. 1st var.—The fourth branch-vein forms an angle, and a short cross-vein passes from it to the second fork of the third branch-vein: in the opposite wing the branches of the second fork having separated reunite, and form a little elliptical areolet, and then again divide to form the fork.

2nd var. The second and the fourth branch-veins are forked near their tips.

3rd var. An additional vein connects the lower branch of the first fork with the second fork of the third vein.

4th var. There is a spurious or supernumerary vein which proceeds from the third vein a little before its first fork, and passes towards the hind-border of the wing, which however it does not attain.

5th var. The fourth vein is forked near its tip.

6th var. With an areolet like that of the second var., but larger and triangular.

81. *Aphis Lychnidis*, Linn.

Aphis Lychnidis, Linn. Syst. Nat. ii. 734. 7; Faun. Suec. 980; Fabr. Syst. Ent. 737. 1; Sp. Ins. i. 2. 384. 4; Ent. Syst. iv. 210. 2; Syst. Rhyn. 294. 2; Gmel. ed. Syst. Nat. i. 2203; Schrank, Faun. Boic. ii. 114. 1214; Berk. Syn. i. 119; Stew. El. ii. 110; Turt. ii. 703; Kaltenbach, Mon. Pfl. i. 92. 67; Reaum. Ins. iii. 281. 340.

A. Cucubali, Linn. Faun. Suec. 719.

Lychnidaphis, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 478.

This species feeds from April to November on *Lychnis viscaria*, *L. diurna*, and *Cucubalus Behen*.

The viviparous wingless female. This is hatched in April, and is remarkable for its shining and glutinous appearance: the body is rather small, black, oval, very convex and plump, dark green beneath: the feelers are black, slender, more than half the length of the body, pale yellow towards the base which is black: the eyes are dark brown: the mouth is pale green: the nectaries are about one-twelfth of the length of the body: the legs are pale yellow; the knees, the feet, and the tips of the shanks are brown. When young it is dark green, or pale greenish red, or pale brown: the head is pale green: the limbs are almost or quite white.

The viviparous winged female. The pupa unfolds its wings in the middle of May: it is then black and shining: the fore-border and the hind-border of the fore-chest are dull tawny, which is also the colour of the abdomen beneath, and at the base above: the feelers are as long as the body; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is nearly as long as the third: the mouth is black with a pale yellow base: the nectaries are about one-eighth of the length of the body: the legs are dull yellow; the feet and the tips of the thighs and of the shanks and the greater part of the hind-thighs are black: the wings are colourless, and much longer than the body; the

wing-ribs and the rib-veins are yellow ; the brands and the veins are brown, and the latter are very distinct.

1st var. The seventh joint of the feelers is hardly longer than the fourth.

2nd var. The mouth is dull yellow with a black tip.

3rd var. The nectaries are one-tenth of the length of the body.

4th var. The legs are black : the base of the thighs is yellow in the fore-pair, and has a slight tinge of yellow in the rest.

The oviparous wingless female? The head, the underside, and sometimes the chest, and even the whole body, are red : the mouth is pale yellow with a black tip. Found in the autumn.

The winged male? Black, and very small : the abdomen is very dark green : the feelers are a little longer than the body : the mouth is dull yellow ; its tip and the nectaries are black, and the latter are as long as one-sixth of the body : the legs are black ; the base of the fore-thighs, and the shanks, except their tips, are dark yellow : the wings are nearly twice the length of the body ; the wing-ribs are pale yellow. In the beginning of November.

Length of the body $\frac{1}{2}$ – $\frac{5}{8}$ line ; of the wings $1\frac{3}{4}$ – $2\frac{1}{4}$ lines.

[To be continued.]

XXVIII.—*Notes on a species of Hydra found in the Northumberland Lakes.* By ALBANY HANCOCK, Esq.

[With two Plates.]

ON visiting the Northumberland lakes last August for the purpose of prosecuting my inquiries respecting the freshwater Ascidian Polypes, I took a very beautiful *Hydra* abundantly in Brömley Lough. On a subsequent occasion numerous specimens of the same species were also obtained in Crag Lough. They were found associated with the various *Bryozoa* that inhabit these waters, adhering to the under side of stones that lie scattered by their margins, and in situations where there was neither mud nor vegetation. From the peculiar character of the locality, so different from that of the usual habitat of the *Hydræ*, I was induced to examine the specimens with great care, and find that they do not exactly agree with any of the known forms, though they come very near to *H. fusca*, of which they may probably prove to be a variety.

On removing from the water a stone to which these *Hydræ* are attached, they appear as irregular, minute, depressed globules of gelatine of a pale red flesh-colour, dispersed over the surface, sometimes in great numbers on one stone, but never crowded on each other. When placed in a bottle of water they soon become fixed to its sides, and spreading out their tentacles display them-

selves to great advantage. They are now seen to be very variable in form, Pl. VI. figs. 3, 4,—or rather that they have great command over it, contracting themselves until they are almost globular or vase-like, with the tentacles very short and swelled out in the centre; then, extending themselves, they become linear, much attenuated, and frequently half an inch long,—the tentacles, fig. 5, being very delicate, and tapering imperceptibly towards the extremity which is enlarged and rounded, forming a nodule or bulb of no great size, but quite visible to the naked eye. The polype, however, is usually much less extended, and is generally a little bulged in the centre; the tentacles are then somewhat longer than the body, but are shorter than it when the animal is fully stretched out. There are usually six tentacles, occasionally five, rarely seven; they are white, never coloured in the centre like the body, which, as already stated, is a red flesh-colour; it is also sometimes yellowish. The colouring, which is apparently much affected by exposure to light, depends on the granules that line the internal or digestive cavity, and is most intense near the mouth.

When in their native haunts, attached to the under side of stones, the *Hydræ* must be nearly in total darkness; but on being placed in a bottle they become exposed to the solar rays, and in the course of a few days are almost completely bleached. Supposing that this loss of colour was occasioned by the want of food, the specimens were supplied with animalcules; but their original hue was not in the least restored.

During the first week or ten days the captives added greatly to their number by gemmation, the buds sprouting from the lower portion of the body,—rarely more than one at a time. Afterwards the budding was much less frequent; and in about a month from the time they were taken, most of the specimens had perished. Two or three, figs. 1 & 2, more favourably placed than the rest, continued to live on for some time longer, and thrived well; but they changed considerably in appearance. A short way below the tentacles two tubercles, *a, a*, had developed themselves opposite to each other, and were in every respect symmetrical; and the body was considerably enlarged towards the lower extremity. In this state the animal had a pedunculate appearance, and I was quite at a loss to account for the change. These specimens belonged to the first batch procured in Bromley Lough. On visiting the lakes again, however, in September, and getting a fresh supply, nearly all the individuals exhibited the same appearances; the tubercles being invariably a little below the tentacles, though not always symmetrically placed; and occasionally they were three and even four in number: the swelling, too, on the lower part of the body varied in different specimens.

On placing one of them, Pl. VII. fig. 5, under the microscope, the tubercle was found to be vesicular, of a conical form, with the apex obtuse, and to resemble in texture the general surface of the animal: the basal portion contained an opaque, rosy, granular body, *a*, of a glandular appearance, which completely filled the base of the tubercle; the apex, *b*, was pellucid, and on being attentively examined a crowd of very minute moving bodies were observed within it.

Whilst watching with great earnestness the motion of these mysterious bodies, all of a sudden the apex of the tubercle burst, and a great number of them, cloud-like, rushing into the surrounding fluid, dispersed in all directions. The rupture appeared to close again, and the apex was seen to be almost empty; but fresh bodies making their appearance the receptacle was soon as full as ever. I have seen the eruption of these corpuscles on several occasions, and have no doubt that it is a natural phenomenon;—not resulting from any artificial means,—certainly not from pressure, as the animals were always quite free. On examining these moving bodies, fig. 12, which are exceedingly minute, with $\frac{1}{8}$ th of an inch object-glass, they were found to be of an elliptical form, and to resemble spermatozoa; tails, however, were not detected, though with a higher power it is not improbable that they may be found; for I could not satisfy myself of their non-existence.

The nature of these tubercles or sacs is a matter of much interest. They were discovered by Ehrenberg, and described by him as the male organ,—the moving bodies being considered spermatozoa. Though I have not seen the original memoir on the subject, I think there can be little doubt of the accuracy of this opinion. How else can we account for the constancy of the appearance of these sacs?—for their development at the time the eggs are being produced, as we shall afterwards see is the case?—for their being situated always on the same part of the animal?—for the contained gland-like body, and moving corpuscles?—for the eruption of these latter bodies, and for their resemblance to spermatozoa?

Having thus detected what I believed to be the male generative organ, I was anxious to watch the development of the egg, which appears to have been already described more than once; but as it has rarely been observed by British naturalists, I will venture to give my own remarks on the subject. The lower portion of the body, as before stated, is enlarged at the time when the male organ makes its appearance. On examining the enlargement, Pl. VI. figs. 1 & 2 *b, b*, carefully, it is found to be usually greater on one side than the other; here it is opaque and of a pale rosy hue, notwithstanding that the animal is faded

under the effect of light. The opaque swelling extends nearly round the body,—the margins being generally distinct. This is the nascent ovum, as it appears at first; it gradually increases in size, Pl. VII. fig. 1 *d'*, and ultimately becomes very protuberant, bulging the body excessively on one side: the egg at this time is confounded with its covering; but it, *d*, is soon seen as a rounded, somewhat flattened body contained within a transparent envelope, *e*, resembling the general surface of the body, of which it is apparently a continuation. This envelope, fig. 2 *b, b*, shortly opens at the highest point of the swelling, and the egg, *a*, gradually makes its way through the orifice, which as gradually enlarges until the egg, figs. 3 *b* & 4 *e*, is completely exposed, and rests, as it were, within the mouth of a shallow cup, figs. 3 *e, e*, & 4 *g*, the contracted envelope. The egg remains in this position for a day or sometimes longer, attached to the body of the parent by a short, thin pedicle, figs. 3 *d* & 4 *f*: the margins at first are generally undulated, as in fig. 4; afterwards the egg becomes almost completely globular. It is ultimately detached, and soon fixes itself to some foreign body. On watching one individual through the microscope, the egg was observed to separate from the parent, and to move slowly away. No ciliary action could be detected to account for the motion; but it assuredly passed out of the field of view as often as the instrument was adjusted: in another instance, however, no motion could be observed. The egg, Pl. VI. fig. 6, in the course of an hour or so became stationary, and several minute globules, *a, a, a*, which had been noticed sticking to it from the first, Pl. VII. fig. 3 *c, c*, enlarged, and others made their appearance: they soon assumed the character of delicate cells, fig. 7, filled with globular bodies with dark margins. These globules are probably composed of some tenacious mucus with which to glue the egg to any substance on which it may happen to settle. Soon after attachment these bodies disappear, and the egg, which is now perfectly circular, is seen to be surrounded by a narrow, transparent rim, indicating the presence of a distinct chorion; the under side of the egg being flattened, the upper side convex, opaque and rosy as at first.

I have not been able to determine with precision how many eggs are produced by each polype, but certainly no great number, probably not more than three or four, and in some instances perhaps only one. On one occasion after the egg separated from the animal, the latter gradually dwindled in size and ultimately disappeared. Most frequently, however, the polype is not materially altered on giving birth to an egg; and occasionally two, Pl. VII. fig. 1 *d', d*, are in process of development at the same time, generally from opposite sides, one being more advanced than the other.

The male organ is only developed at the time the eggs make their appearance. In August, shortly after the polypes were procured, they multiplied rapidly, as we have seen, by gemmation, and at this period none of the sacs containing spermatozoa were observed. It was not until they had ceased to propagate in this way, some time in September, that the male organ was developed, and it was always visible afterwards, though variable in size.

All the individuals apparently produce eggs, and all are alike provided with the spermatie sacs; at least the ovum in various stages of development and the male organ are seen at the same time in most specimens: it is not uncommon, however, to observe the male organ only, the egg probably having just left the body of the parent, though I do not recollect having seen the egg in process of development in individuals unprovided with the sperm-vesicles.

It is worthy of remark, that the buds sprout from the same part of the body in which the eggs are developed; but I have seen nothing to warrant the assertion that the ova after impregnation "sometimes are retained and then grow out like buds." Indeed it is probable that fecundation does not take place until the egg bursts through the integument, and is attached to the parent only by a delicate pedicle. This would appear more likely than that impregnation should be effected through the skin of the animal. Whilst watching an individual when the egg was about to separate from the parent, the sperm-vesicle was frequently brought, by the contractions of the body, almost in contact with the ovum; thus fecundation might very easily be effected, and at a moment, too, when from analogy it might be expected to take place: more observations, however, are required to settle this point.

I have also observed sperm-vesicles, Pl. VII. fig. 6, in *H. viridis*: in this species they are much smaller than in the specimens from the Northumberland lakes, and are generally two or three in number, near the anterior extremity of the body, but without symmetrical arrangement. They are irregularly conical, with the base wide, within which there is likewise a distinct glandular body of a green colour; the moving bodies are very numerous, and occupy, as in the other species, the transparent apex. The sperm-vesicles were noticed in *H. viridis* after it had ceased to bud, some time early in October.

The tentacles, Pls. VI. & VII. figs. 5, 7, of the flesh-coloured species are very rough and beautiful, exhibiting an imperfect spiral arrangement of the nodular enlargements. There are two kinds of vesicles immersed in the nodules, as have been described in some other species; one being much more numerous and smaller than the other. The former are for touch, the latter for

prehension, according to Corda, who appears to have examined these organs with great care, but whose description of one of them is erroneous in several respects: the original memoir, however, I have not seen. Neither have I had an opportunity of consulting Ehrenberg's account of the minute structure of the tentacles of these animals. The smaller vesicles, Pl. VII. fig. 7 *a*, and fig. 8, seem to agree with Corda's description as given in Johnston's 'British Zoophytes'; they are elliptical, being composed of an inner and outer sac, both very delicate, transparent and membranous. These bodies are placed with their long axis perpendicular to the surface of the nodule in which they are imbedded, and have a non-contractile hair-like process projecting from the external end.

The larger vesicles, fig. 7 *b*, are very complicated, and appear to have been only partially understood by Corda, though he had arrived at a full comprehension of their functions. They are not merely prehensile organs, but are undoubtedly also stinging instruments, as supposed by this naturalist, and are at least twice as large as those for touch: they, fig. 9, are of an ovate form, short and stout, immersed in the substance of the nodule with the narrow end uppermost, and immediately beneath the surface. At the bottom of the vesicle, which though perfectly transparent has rather thick walls, is seen a delicate lining membrane, *d*, folded down upon itself, having a cup- or saucer-like appearance. This, according to Corda, is "a saucer-like vesicle." Standing up from the centre of this is a transparent membranous stalk, *c*, irregularly bulged a little at the sides, and surmounted by a sharp arrow-like head, *b*, with the barbs much depressed. This supporting stalk is described by the naturalist just quoted as "a solid, ovate corpuscle." But to get a full knowledge of this apparatus, it must be examined when exerted and ready for action. The saucer-like vesicle is then seen to have disappeared, and the outer vesicle, fig. 10 *a*, is lined throughout with a delicate membrane, *b*; in fact the lips or margins of the saucer-like vesicle have unrolled themselves and now form the upper portion of the lining membrane, the saucer itself being the lower portion of it. And moreover the lining membrane is continued through the neck of the outer vesicle, and is seen to be prolonged into the stalk, *c*, supporting the arrow-head; the barbs, *c'*, of which, three in number, are now very much elevated, being almost horizontal; and thus protruded beyond the surface of the tentacle are ready to lay hold of prey in the manner of a grappling-iron.

The animal would appear, however, to have the power of throwing the whole apparatus from the tentacle. If a specimen be laid on a piece of glass and examined through the microscope, a number of these organs with the barbs fully extended will be

seen scattered about like as many minute Florence flasks ; the bulbous extremity being elegantly rounded. For the purpose of ascertaining if the animal really possessed this power, a small worm was given to a polype when under the microscope, and carefully watched. The animal was exceedingly cautious in using its tentacles, not applying them in their whole extent as might have been expected, but keeping by far the greater portion of these organs perfectly free and unattached to its prey. Very few of the arrow-heads were exerted, and apparently never till required ; occasionally certain parts of the tentacles were brought into contact with the worm, and then, as it was forcibly drawn further into the mouth, the protruded barbs might be seen sticking in the surface of the struggling victim. At other times, as it rolled about in its vain endeavours to escape, the bulbous extremities of several of these formidable weapons were seen protruding from the skin, undoubtedly placed there by the pungent embrace of this deadly and determined foe ; while others lay scattered about in every direction as if just cast from the tentacles. It is therefore evident that these weapons can be used either as grappling instruments for securing food, or having been plunged into some living prey, can be left half-buried in the wound. Indeed when the barbs have been once fairly immersed, it is difficult to conceive how they can be withdrawn ; and therefore it is probable that the tentacles can only be disengaged by moulting these organs, which seem to be very slightly attached by the neck of the flask-like portion.

This, however, may not be the only reason why these weapons are left in the wound. It has been stated that they are stinging as well as captor organs, and if so may require time to pour the poison into the wounded animal. The deadly fluid is probably contained in the bulbous portion of the instrument, and by the contraction of its walls may be forced through the other extremity which is perforated ; at least from the extreme point a long, delicate filament, fig. 10 *d*, almost invariably protrudes, resembling very closely the appearance of the long process attached to the stinging bodies thrown out of the papillæ of *Eolis*, and from the tentacles of *Actinia*. But other bodies much more closely resembling the stinging organs of these animals were found strewn about associated with the captor organs. These bodies, fig. 11, are minute elliptical sacs with a long, slender filament from one end like that just mentioned from the pointed extremity of the captor organ. The filaments of both these bodies have a double margin, and are apparently tubular. Now it is more than probable that these elliptical sacs are thrown out of the captor organ, and that the filament, so frequently seen

issuing from its pointed extremity, belongs to one of them about to be exerted.

We thus see that *Hydra* is provided with a most efficient stinging apparatus, which having penetrated the surface of its prey remains fixed there, discharging into the wound its poison-bearing filaments. No wonder then that the embrace of these animals should be so deadly to the animalcule that comes within their reach; and that the worm so tenacious of life should fall paralysed from their touch and die, as we are told, almost without a struggle.

The captor organs of *Hydra viridis* are exactly similar to those just described, but are scarcely more than half their size. In this species, too, they are cast from the tentacle.

Corda considers the arrow-head, and what he calls the ovate corpuscle, which we have seen is the membranous stalk supporting the barbs, to be calcareous. Acetic acid, however, has no effect on these parts; and they resist nitric acid for some time, but in the course of an hour or two almost disappear under the influence of this powerful fluid. It is therefore evident that neither of these parts is calcareous: the arrow-head and barbs are probably composed of horny tissue, or some other substance with which we are unacquainted.

It appears that Corda has also determined the existence of an anal outlet at the posterior extremity of the animal. I have likewise seen what I take to be a similar outlet. On examining a specimen in a highly contracted state, and which was about to discharge an egg, a distinct, constricted, linear channel, Pl. VII. fig. 4 *b*, was observed passing from the digestive cavity through the substance of the adhesive disc, apparently about its centre. From this channel issued a long, linear mass, *c*, of excrementitious matter composed of a tenacious mucus imbedding a granular substance resembling both in colour and texture that which lined the digestive cavity.

The true nature of this outlet is enigmatical, since it is known that the refuse of digestion is discharged by the oral orifice. Professor Owen suggests that "it may give passage to certain excretions of the villous lining membrane of the alimentary canal." From the facts just mentioned it would appear that this conjecture is probably correct.

EXPLANATION OF PLATES VI. AND VII.

PLATE VI.

Figs. 1, 2. Two much-enlarged views of the *Hydra* from the Northumberland lakes after development of the sperm-vesicles: *a, a*, sperm-vesicles; *b*, ovum in early stage of development.

- Figs. 3, 4. Two much-enlarged views of the same before development of the sperm-vesicles.
- Fig. 5. Two highly magnified views of the terminal portion of the tentacle, exhibiting nodular enlargements, *a*, and terminal bulb or nodule, *b*.
- Fig. 6. Egg after attachment to some foreign body much magnified, exhibiting chorion : *a, a, a*, a few of the mucus-globules contained in vesicles adhering to the egg.
- Fig. 7. A few of the same vesicles containing mucus-globules more highly magnified.

PLATE VII.

- Fig. 1. *Hydra* much enlarged, exhibiting development of ova : *a*, basal portion of tentacles ; *b*, mouth ; *c, c*, sperm-vesicles ; *d'*, ovum considerably advanced ; *d*, ovum just before it bursts through its envelope, *e*.
- Fig. 2. Much-enlarged view of egg as it appears immediately after it has burst the envelope : *a*, egg ; *b, b*, margins of envelope ; *c, c*, portions of the animal.
- Fig. 3. A portion of *Hydra* much magnified, exhibiting the egg when ready to separate from parent : *a*, portion of the animal ; *b*, egg ; *c, c*, mucus-globules as they at first appear ; *d*, pedicle attaching egg to parent ; *e, e*, contracted margins of envelope.
- Fig. 4. Enlarged view of *Hydra* much contracted with egg attached, exhibiting anal orifice : *a*, mouth ; *b*, anal orifice as seen through the substance of the adhesive disc ; *c*, fæces passing out of same ; *d*, sperm-vesicle ; *e*, egg with undulated margins ; *f*, pedicle attaching same to parent ; *g*, contracted margin of envelope.
- Fig. 5. Sperm-vesicle much enlarged of the *Hydra* from the Northumberland lakes : *a*, gland-like body within the base of same ; *b*, apex of same containing spermatozoa ; *c, c*, a portion of surface of animal.
- Fig. 6. Sperm-vesicle much enlarged of *H. viridis* : *a*, gland-like body within base of vesicle ; *b*, apex of same containing spermatozoa ; *c, c*, surface of animal.
- Fig. 7. Much-enlarged view of portion of tentacle of the flesh-coloured *Hydra* as seen in the compressor, exhibiting captor organs and organs of touch imbedded in the nodular enlargements : *a*, organs of touch ; *b*, captor organs.
- Fig. 8. Two of the organs of touch greatly magnified, exhibiting inner and outer vesicles and cilium.
- Fig. 9. Greatly enlarged view of retracted captor organ : *a*, outer vesicle ; *b*, arrow-head with barbs depressed ; *c*, membranous stalk of same ; *d*, inner or lining membrane doubled down upon itself.
- Fig. 10. Captor organ exerted : *a*, outer vesicle ; *b*, inner or lining membrane ; *c*, membranous stalk supporting arrow-head with the three barbs, *c'*, elevated ; *d*, filament passing out of the pointed extremity of arrow-head.
- Fig. 11. Two enlarged views of elliptical sacs with filaments supposed to be poison-organs cast from captor organ.
- Fig. 12. Two of the spermatozoa highly magnified from sperm-vesicle of flesh-coloured *Hydra*.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 27, 1849.—Wm. Yarrell, Esq., Vice-President, in the Chair.

The Secretary communicated to the Meeting a letter which had been addressed to the Council by Sir Roderick Impey Murchison, G.C.St.S., &c. &c., in which he gave the gratifying intelligence of his having been assured by the Count Kisselef, Minister of the Imperial Domains of Russia, that if it was possible to obtain another Male Aurochs, it would afford his Excellency the greatest pleasure to receive the high command of His Majesty the Emperor for its transmission to the Society. Although the communication of Count Kisselef did not amount to an absolute promise, Sir Roderick expressed his conviction, that with so earnest an intention of assisting the Society on the part of the confidential Minister of his Imperial Majesty, there was still a chance of the Aurochs again living and reproducing its species in Britain.

The following paper was read :—

MONOGRAPH OF THE LARGE AFRICAN SPECIES OF NOCTURNAL LEPIDOPTERA BELONGING OR ALLIED TO THE GENUS SATURNIA. BY J. O. WESTWOOD, F.L.S. ETC.

Linnæus, in pursuance of the plan which he generally adopted, of placing the largest species of any group at its head, introduced as the first species of the Nocturnal Lepidoptera (the whole of which constituted in his System but one genus, *Phalæna*) those gigantic moths of which the *Phalæna Atlas* may be considered as the type, distinguished both by himself and Fabricius by the character "*alis patulis*." Placed thus at the head of this great division, and being in themselves some of the most gigantic and at the same time most beautiful of the insect tribes,—valuable also to the human race on account of the product obtained from several of the species,—I have thought that a synopsis of the African species (a considerable number of which are now for the first time described and figured, and several of which, being inhabitants of Southern Africa, appear as likely to afford a supply of silk as their Indian relatives,) would not be without interest.

So little however has hitherto been effected in the classification of the nocturnal exotic Lepidoptera, even of the larger species, and in fact so completely have the chief characters, on which a real distribution of these insects can alone be established—I allude more especially to the arrangement of the veins of the wings and the transformations of the insects—been neglected, that it is impossible, without a revision of the whole of the family *Bombycidae*, to arrive at the most satisfactory plan of arrangement of a geographical selection of the species. It will however not be useless to notice the attempts which have been made relative to the arrangement of these insects. Dr. Boisduval, in his 'Genera et Index Methodicus,' has divided the Heterocera into a number of tribes of equal rank, amongst which is the

*Saturnides**, characterized thus : “Larvæ obesæ arboricolæ, segmentis prominulis, modo tuberculis piligeris, modo spinis verticillatis vel pennatis instructæ. Folliculum tenax. Alæ patulæ latæ sæpius macula ocellari vel diaphana ornatæ : lingua nulla.” The tribe comprises the single genus *Saturnia* of Schranck and Ochsenheimer (*Attacus*, Germar), with the four European species *Pyri*, *Spini*, *Carpini*, and *Cæcigena* as its types. The characters given by Boisduval are sufficiently precise, but those obtained from the peculiar structure of the antennæ and of the veins of the wings, which Boisduval has not noticed, are far more distinctive. M. Boisduval’s next tribe, *Endromides*, is a very artificial one, consisting of the two genera *Aglaia* and *Endromis*, which possess but little in common : *Aglaia Tau*, in fact, possesses the broad, flat, pennate, male antennæ of *Saturnia*, with which it also agrees in each joint emitting four branches, two at the base and two at the apex, the latter pair being shorter and more slender than the former ; moreover, each branch of the former pair has its fore-margin fringed with very delicate hairs, directed of course to the tip of the antennæ, and its apex is furnished with two stronger bristles, also extended in the same direction, and each of the latter pair of branches has its hinder margin similarly fringed, the hairs of course being directed towards the base of the antennæ, and nearly meeting the opposite row of hairs supplied by the basal branches of each joint. This very peculiar structure, also possessed by the giant *Saturniæ* (alone, as I believe), has not been previously noticed by any writer with whose works I am acquainted, and would most probably afford physiological peculiarities of much interest. The veins of the wings of *Aglaia* are also disposed on the same general plan as in the *Saturniæ*, namely the apical portion of the fore-wing is traversed by six branches, three arising from the great median vein and three from the post-costal vein, the two hindermost of the latter uniting together near the middle of the wing : there is however this difference between the wings of *Aglaia* and *Saturnia* ; namely, that whereas in *Saturnia* the first branch of the post-costal vein is very minute, consisting of a scarcely visible, almost transverse veinlet, occurring halfway between the tip of the costal vein and the extremity of the wing, in *Aglaia* this first branch of the post-costal vein is longer than all the rest, arising at about one-third of the length of the wing from the base. Thus *Aglaia* and *Saturnia* agree in possessing a simple costal vein, a post-costal vein with five branches, a median vein with three branches, and a simple anal vein. We also find that, like *Saturnia*, all the wings in *Aglaia* are marked in the middle with an eye-shaped spot. Boisduval however appears to have considered that the transformations of *Aglaia* were the chief grounds for separating it from the *Saturnides* : he describes the larvæ of *A. Tau* as “rugulosæ, per juventutem spinigeræ ; adultæ muticæ. Folliculum sub-nullum. Puppa muscis vel foliis demortuis obtectæ†.”

From the preceding considerations I am induced to regard *Aglaia* as belonging to the same subsection or tribe as *Saturnia*, considering the differences of metamorphosis existing between them as more than

* Op. cit. p. 73.

† Op. cit. supr. p. 74.

counterbalanced by the striking similarity of their more important characters in the perfect state. As to the connexion between *Aglais* and *Endromis*, proposed by Boisduval, I cannot consider it as possessed of any real existence, *Endromis* having a totally different arrangement of the wing-veins, the apical portion of the fore-wings being traversed by seven branches, namely four arising from the median vein, and three simple ones arising from the post-costal vein, the wing being furnished with a simple costal, a 5-branched post-costal, a 4-branched median and a simple anal vein. Now this is the typical number of branches which a lepidopterous wing ought to possess, according to the theory of Mr. Edward Doubleday, that we are to suppose the existence of a discoidal vein traversing the middle of the discoidal cell, and that this discoidal vein, as well as the post-costal and median, are respectively furnished with three branches. According to this theory therefore, the two branches of the post-costal vein which run to the tip of the fore-wing of *Endromis*, together with the first branch traversing the front of the disc of the apical portion of the wing, are the only real branches of the post-costal vein; the two following branches of the post-costal vein, as I have regarded them, and the first branch of the median vein, are the branches of the supposed discoidal vein, and the three remaining branches of the median vein are its only true branches. I do not intend in this place to enter into a detail of the reasons which induce me to refuse assent to this theory; I may however observe, 1st, that with regard to the functions of these branches, it is evident that the fourth branch of the median vein, where present, must form a portion of the system of circulation effected by the branches of the median vein, just as in like manner the three branches of the post-costal vein of *Saturnia*, which traverse the apical portion of the fore-wing, must be considered as effectually forming a portion of the post-costal vein; 2ndly, that it seems to me contrary to analogy to admit the existence of fully-developed branches of a vein, the base of which has no real existence; and 3rdly, that instances occur (e.g. *Psyche Stettinella*, *Cochleophasia tessellea*) in which the number of branches exceeds the supposed typical number of nine (*i. e.* three post-costal, three discoidal, and three median), those insects having ten branches, in which case one of the veins must have an extra branch; whilst in *Saturnia* for instance, the supposed discoidal vein can only have two branches,—hence I see no reason why cases may not be supposed in which one vein should have more, and another vein fewer, than the typical number of branches; or, in other words, why the median vein in *Endromis* should not have four branches, whilst there are only five branches for the post-costal and supposed discoidal veins.

The antennæ also of *Endromis*, as well as its transformations, are quite different from those of *Aglais* and *Saturnia*; indeed the tribe *Endromides* of Boisduval seems to possess no single connecting character.

Hübner, in his ‘Verzeichniss bekannter Schmetterlinge*,’ has attempted an arrangement of these insects which appears to me unnatural, so far as the primary divisions are concerned, whereas his inferior

* Augsburg, 1816, 8vo.

groups (*Coitus*), founded almost entirely upon the form and marking of the wings, appear to bring together the closely allied species. His first tribe of the Bombycoid Nocturnal Lepidoptera is termed *Sphingoides*, and contains five stirpes:—1st, *Dimorphæ* (*Endromis*, *Chao-nia*, *Petasia*, &c.); 2nd, *Ptilodontes* (the Prominent Moths); 3rd, *Andriæ* (*Stauropus*, *Cerura*, &c.); 4th, *Platyptericides* (*Drepana*, *Platypteryx*, &c.); and 5th, *Echidnæ*, composed of *Aglaia* and a number of *Saturniæ*. The second tribe of the Bombycoid Nocturnal Lepidoptera is termed *Veræ*, and consists of the remainder of the *Saturniæ* (*S. Pavonia*, *Pyri*, &c.); *Apollonia*, Cram.; *Maia*, Drury; *perspicilla*, Stoll; *Cedo nulli*, Cram.; and *Pandiona*, Cram., in separate coitus, forming a first stirps *Herææ*; the remaining stirpes, composed of the *Penthophoræ*, *Lariæ*, *Orgyia*, *Lithosia*, *Arctiæ*, *Lasiocampæ*, *Gastropachæ*, &c.; and the third tribe of the Bombycoid Lepidoptera being composed of *Hepialus*, *Cossus*, and *Zeuzera*.

By this arrangement it will be seen that *S. Pavonia*, *Pyri*, &c., and the other species above named, are separated from the great body of the *Saturniæ*, a step for which I can see no real grounds, the characters of those species in the preparatory and perfect states agreeing with those of the stirps *Echidnæ* far more intimately than with any of the other Bombycoid Nocturna, constituting the tribe named *Veræ*.

Mr. James Duncan, in the volume of Exotic Moths forming part of Sir W. Jardine's Naturalist's Library (vol. vii. 1841), has suggested a mode of distribution of the *Saturniæ*, founded upon the form of the wings in the two sexes of the different species, of which the following is a sketch:—

1. Those with the hind-wings rounded in both sexes.

Genus 1. *Hyalophora* [or the *Speculares Attaci* and *Samia* of Hübner], with large vitreous spaces on the disc of the wings: *Atlas*, *Hesperus*, *Cecropia*, &c.

Genus 2. *Attacus*, with eye-like spots on the wings, containing the great majority of the species.

2. Those with the hind-wings furnished with an angular projection posteriorly.

Genus 3. *Arsenura* [*Rhescyntes* of Hübner]. Hind-wings of male alone angulated. Sp. *Erythrina*, Fab.

Genus 4. *Lomelia* [*Imbrasia* of Hübner]. Hind-wings of both sexes angulated. Sp. *Epimethea*, Drury.

3. Those with the hind-wings produced into a long tail.

Genus 5. *Actias*, Leach [*Tropæa*, Hübner]. Tail about the length of the body. Sp. *Luna*, Linn.

Genus 6. *Eustera* [*Eudæmonia*, p. Hübner]. Tail very long; apical margin of fore-wings rounded. Sp. *Argus*, Fab.

Genus 7. *Copiopteryx* [*Eudæmonia*, p. Hübner]. Tail very long; fore-wings truncated. Sp. *Semiramis*, Cram.

The application of the character derived from the variation in the form of the wings in the two sexes of the different species is a step gained in their arrangement; it must however be admitted that the species with rounded hind-wings, forming Mr. Duncan's first section, must be cut up into a considerable number of subsections to place

them on an equivalent footing with the species with angulated or tailed hind-wings. Moreover the existence of large vitreous patches on the wings is not sufficiently important for the formation of genera among these insects, since it is found gradually obliterated in a series of the species by the space being more and more clothed with scales, until, as in our common *Saturnia*, all that remains of the vitreous spot is a narrow lunule at the base of the pupil of the eye-like spot. Although Mr. Duncan's observation, that "the species in which the fore-wings of the male are most decidedly falcate have this form much less strongly marked in the female; where the former are not very strongly falcate, in the female they become subfalcate (*H. Promethea* may serve as an example), while the females of subfalcate winged males have the exterior outline of their fore-wings either straight or slightly curved outwards"—is correct, yet he has carried it too far in proposing to unite together two insects belonging to different genera, and equally far removed in their geographical range, namely the curious *Saturnia Lucina* of Drury (which possesses very strongly falcate fore-wings, the veins of which, as is evident from Drury's figure, are arranged as in the typical *Saturnia*, and which I find recorded in Drury's MSS. to be a native of Sierra Leone) and the Assamese *Bombyx spectabilis**, described by Mr. Hope in the Linnaean Transactions (vol. xviii. part 3, figured in pl. 31. fig. 3. from my drawing), which possesses an outwardly rounded apical margin of the fore-wings, and which, as may be seen from my figure, has a different arrangement of the veins of the fore-wings, the apical portion of the disc of which is traversed by seven branches, the innermost pair of the post-costal vein not being united together in a fork on the disc; the insect in fact belonging rather to the group of which *Lasiocampa* is a good type†.

* This species is the *Bombyx Certhia*, Fabricius, Ent. Syst. iii. 412; *Bombyx Wallichii*, Gray in Zool. Misc. p. 39; and *Phalæna maxima*, Chusan, Petiver. Gaz. t. 18. fig. 3.

† I may take this opportunity of describing a very fine new species of *Lasiocampa* from Tropical Africa, in my own collection.

LASIOCAMPA STRIGINA, Westw. *L. alis anticis pallide incarnato-albidis strigis quatuor fulvo-castaneis, posticis basi fuscis strigis tribus transversis albis, pone medium fulvo-castaneis.*

Expans. alar. unc. 6.

Hab. Sierra Leone. In Mus. nostr.

The general colour of this insect is a rich chestnut-fulvous or sorrel colour. The basal half of the fore-wings is of a pinkish buff, the pink tint being strongest at the base, and extending across the hind part of the thorax. Between the base and the distance of one-third of the length of the wing, are two straight, transverse, chestnut-fulvous strigæ, which are shaded off gradually to the pale ground colour of the wing; at the distance of one-third is another abbreviated striga of the same kind (indicating the situation where the discoidal cell is closed). Across the middle of the wing is a broad, more oblique chestnut-fulvous bar, shaded off in the same manner; and beyond this, and parallel with it, is another narrow, darker chestnut-fulvous, oblique striga, leaving a broad apical margin of chestnut-fulvous, slightly clouded with an obscure paler wave. The principal veins of the wing are indicated at a little distance beyond the middle by a double row of minute chestnut dots, and along the apical portion by a brighter tint. The fringe is claret-brown. The hind-wings are blackish-brown at the base, with three transverse white fasciæ, the outer ones being close together, and running nearly across the middle of the wing; the apical half of the wing being chestnut-fulvous, with a slight indication of a paler fascia. The antennæ are very pale buff and

As already stated, the insects of the genus *Saturnia* are among the largest of the Nocturnal Lepidoptera, a few *Hepialidæ* and *Erebi* alone equalling them in size. How far this circumstance gives them the character of a typical group may be reasonably questioned; to me indeed it appears that an increased size in the species of any group is in itself a proof of a certain degree of aberration: certainly if strength of flight and compactness of form be considered, we must regard the *Lasiocampæ* and allies as much rather the real representatives of the Linnæan *Bombyces*; just as in the Butterflies, no one would consider the species of *Papilio* on account of their large size as the types, but would confer that title on *Vanessa* and its allies, notwithstanding the want of well-developed fore-legs. Another circumstance which might be alleged as a proof of the typicality of the *Saturnia*, is the wide geographical range of the species, which occur in all quarters of the globe, which peculiarity extends even to the minor divisions of the genus; thus we have very closely-allied tailed species from North America, India and South Africa; I believe however that naturalists have at length agreed in refusing to this circumstance the right of conferring typicality on groups.

Saturnia in fact appears to me to be one of those groups like *Papilio* among the Diurnal Lepidoptera, *Carabus* among the *Carabidæ*, *Feronia* among the *Harpalidæ*, or *Cicindela* among the *Cicindelidæ*, which are of great extent and comprise a number of species, generally of comparatively large size, which it is difficult to group into well-defined sections or subgenera, although their forms are very varied. One or more species may be detached and characterized as distinct subgenera, but when the whole group is carefully studied, it is ascertained that these particular species do not possess more important characters than the rest. I shall not attempt therefore, in describing the African species alone of this group, to introduce a system of distribution among the species, further than the artificial division given below.

The beautiful markings of the wings, and especially of the hind-wings, of many of these insects, appear to indicate the character laid down by Linnæus and Fabricius, namely "*Alæ patulæ*," by which we are to understand, that when the insect is at rest the fore-wings do not closely cover the hind-ones, as is the case in the species with dingy-coloured hind-wings, but leave their beautiful markings exposed to view. Mr. E. Doubleday indeed informs me that the North American *S. Luna* generally sits with its wings perpendicularly elevated over its back, like a butterfly at rest. These beautiful eye-like markings of the wings are indeed a good character of the group, although that which is afforded by the arrangement of the veins above described is of higher importance. The latter indeed, together with the emission of four branches from each joint of the flat pennated antennæ, may be considered as the essential characters of the genus, although they have never hitherto been employed to distinguish it. Another

bipectinated; the tips are broken off in my specimen, the part remaining having seventy-three pairs of rays. Beneath, the wings are paler chestnut-fulvous, with a darker duplicated striga across the middle, and some slightly indicated waved striga beyond the middle.

character, also hitherto unemployed, which will I think prove of importance in determining the minor groups of *Saturnia*, consists of the difference in the number of branches in the antennæ of the different species; this I have carefully noticed in the following descriptions, as well as the differences in the formation of the female antennæ, in which sex some of the species possess those organs almost filiform, whilst in others they are nearly as strongly pennated as in the males.

In the following pages thirty-three African species are introduced, of which seventeen are now for the first time described.

For convenience the following artificial mode of division is employed in their arrangement:—

- A. Fore-wings very sickle-shaped; with a small eye-like spot near the tip.
 - a. All the wings with a glassy lunate central spot. Sp. 1.
 - b. Fore-wings with a central bean-shaped vitreous spot; hind-wings with large oval one. Sp. 2.
- B. Fore-wings less strongly sickle-shaped or rounded externally; all the wings with an eye-like spot.
 - a. Hind-wings not tailed. Sp. 3–10.
 - b. Hind-wings tailed. Sp. 11, 12.
- C. Fore-wings with a small triangular or quadrate vitreous central spot; hind-wings with a large eye. Sp. 13–24.
- D. Wings without eyes or vitreous spots. Sp. 25–28.
- E. Aberrant species. Sp. 29–33.

Section A.

Subsection a.

Sp. 1. SATURNIA VACUNA, Westw. *S. alis maris falcatis fuscis, fascia communi media alba, omnibus lunula magna media vitrea, utrinque albo flavoque marginata; anticisque macula ovali nigra subapicali (albo supra circumdata).*

Expans. alar. ♂ unc. $6\frac{1}{4}$; ♀ unc. $5\frac{1}{3}$.

Inhabits Ashantee. In the British Museum:

The male has the fore-wings considerably falcate at the tips, and the hind ones almost triangular. The female has the fore-wings somewhat emarginate in the middle of the hind margin, and the hind-wings less elongated. The general colour of the wings is brown, thickly irrorated, especially in the males, with white. The fore-wings have a broad suboblique bar, extending from the base of the inner margin and directed forwards in a right angle immediately in front of the central lunule, the margin of which is formed of a narrow brown bar, within which it is dirty yellow, internally edged with white, the central part being vitreous. This is followed by a white oblique nearly straight bar, the brown space beyond which is much-powdered with white; the apical margin is pale livid buff, traversed by a very slender undulating brown line, with a black oval dot near the apex, which is powdered at its base with white; the apex of the wings being rosy fulvous, separated from the livid brown antecedent part of the wing by a very much-angulated white line.

The hind-wings are white at the base, which extends on the out-

side and joins the central white fascia; the apical portion is coloured as in the fore-wings. The lunule is smaller and more curved than in the fore-wings, but similarly coloured.

The antennæ are fulvous. The abdomen whitish buff.

The male antennæ are broad, and have forty-six rays on each side lying flat; the four rays of each joint of equal length. The female antennæ are of considerable breadth, and with forty-eight or fifty rays on each side.

The palpi are very short but distinct and rather slender, and the spiral tongue is also distinct and composed of two flattened free filaments.

Subsection A. b.

Sp. 2. SATURNIA MYTHIMNIA, Westw. *S. alis anticis subfalcatis, omnibus purpureo-fuscis albo-irroratis; et pone medium striga alba valde curvata; anticis lunula magna vitrea albo flavoque marginata; maculaque parva subapicali nigra albo irrorata; posticis ocello magno ovali vitreo albo flavoque marginato, serieque catenata submarginali punctorum nigrorum.*

Expans. alar. antic. unc. $4\frac{3}{4}$ – $5\frac{1}{2}$.

Hab. Port Natal. In Mus. Britann.

The fore-wings are considerably emarginate along the outer margin in the male, and more slightly so in the female. The veins agree in arrangement with the typical *Saturniæ*. The general colour of the wings is a dark livid brownish purple, thickly powdered with white atoms; the middle of each wing is occupied by a large transparent spot, kidney-shaped in the fore-wings and oval in the hind ones; the vitreous portion is surrounded by a slender line of white, which is succeeded by a yellow one, and this by a slender black line; these eyes are of nearly equal size. The fore-wings are also marked near the base with an oblique white fascia, extending from near the base of the fore-wings to the base of the large eye; beyond the eye is a curved white bar, internally edged with a darker bar of livid purple; the apical part of the fore-wings is brown shaded to fulvous and buff; the outer margin of the wing dusky buff, with a series of greenish buff spots edged with a slender brown deeply undulating line; near the tip of the wing is a black spot irrorated with white at the base, from which runs a very slender and much-angulated white line. The hind-wings have a fulvous edge gradually shaded to buff-brown, bearing a row of dark brown catenated spots followed by a slender dusky line. The under side of the wings resembles the upper side, with the costa of the hind-wings white. The body is purplish brown, the thorax behind with a white fascia, and the segments of the abdomen have the hinder margin white. The antennæ, head and legs are fulvous. The antennæ are broadly pennate, with the rays continued to the tip. The males have fifty-eight rays (arranged in double pairs to each joint), with single rays at the tip. The females have also fifty-eight long rays (four to each joint), with eight or ten single rays at the tip. The palpi are porrected, but do not extend beyond the hairs of the clypeus.

Section B.

Subsection a.

Sp. 3. SATURNIA ARATA, Westw. *S. alis flavis; anticis apice acutis basi livide maculatis, medio ocello livido cincto circulo tenui albo, alteroque purpureo marginato, linea tenui dentata media, strigaeque obliqua subundata, posticis ocello magno multiannulato ornatis.*

Expans. alar. unc. $4\frac{1}{2}$ – $5\frac{3}{4}$.

Hab. Ashantee, Sierra Leone and Port Natal. In Mus. Britann.

The fore-wings are nearly alike in both sexes, being but very slightly emarginated in the male, with the tips acute; wings rich yellow, with several livid or reddish patches near the base, followed by a much-waved livid striga; in the middle of the wing is a moderate-sized ocellus, the centre vitreous, outwardly edged with black, surrounded by a livid ring, and this by a white circle, outside of which is a narrow purplish or reddish ring. Connected with the outer edge of the ocellus is a slender, very strongly denticulated dark brown line; beyond this is a nearly straight purplish brown striga, extending from the fore-margin, where it is rather angulated and extending to the middle of the inner margin; beyond this line the outer margin of the wing is marked with confluent livid or reddish patches, the margin itself being of the same colour except at the tip.

The hind-wings are more or less tinged with red at the base, followed by an angulated dark denticulated striga arising from the anal margin. In the middle of the wing is a large brilliantly coloured ocellus; the pupil is black, with a slender vitreous line towards the base; the iris is livid, outwardly shaded to red, surrounded by a slender white circle and this by a red ring. From the inner margin of the eye runs a dentated brown line to the anal margin, and behind it is a waved or dentated brown striga, the apical portion of the wing being coloured as in the fore-wings. The thorax is yellow, with the head, collar and legs livid brown. The wings are much less brilliantly coloured on the underside, and the great ocellus of the hind-wings is almost obliterated. The vitreous part of the ocellus of the fore-wings is much smaller in the male than in the female; and the ocellus of the hind-wings in the female is much more vividly coloured than in the male.

The antennæ of the males are 32-jointed with forty-eight rays on each side, the two apical rays of each joint being rather shorter than the two basal ones.

The palpi are short, but distinct and broad; the basal joint with scales extending beyond the second joint. The antennæ of the female are 37-jointed, the rays being about three times as long as the thickness of the antennæ, and the two apical rays of each joint being quite short.

Sp. 4. SATURNIA BELINA, Westw. *S. alis anticis flavo-griseis, striga subangulata ante, alteraque fere recta pone medium; ocello mediano hyalino fulvo-cincto; alis posticis rubidis ocello*

magno vitreo iride fulva nigro circumdata strigaeque subapicali alba, fusco externe marginata.

Expans. alar. antic. unc. $4\frac{1}{2}$ – $4\frac{3}{4}$.

Hab. Port Natal et Zoolu. In Mus. Britann.

The fore-wings are nearly alike in both sexes, the outer margin being scarcely emarginate. The general colour is uniform obscure yellowish grey, covered with minute black irrorations; at the distance of about one-third of the length of the wing from the base is a rather narrow white transverse striga, slightly angulated outwardly, having a dusky edge on the inside next the base of the wing. In the middle is a rather small ocellus, the centre being semi-oval and vitreous, edged with fulvous, and surrounded by a thin black circle; this is surrounded by a dull buff ring, and this by a white one; beyond the middle is an oblique nearly straight white striga, nearly parallel with the outer margin, outwardly edged with a dark brown line. Hind-wings pale livid pink at the base and along the anterior portion; near the base is an obscure white striga, and in the middle is a large oval ocellus, coloured in the same manner as the ocellus of the fore-wings, and followed by a curved white striga edged outwardly with brown.

The thorax is coloured as the fore-wings, with a narrow transverse white ring across the front. The abdomen is more strongly fulvous-coloured. Wings beneath grey, the fore-ones tinged with pink on the inner margin; across the middle is a fulvous cloud; the basal fascia and the eyelet of the hind-wings are wanting. The veins are arranged in the typical manner.

The male antennæ are 35-jointed with fifty-six rays on each side, the rays rather long; the two basal rays of each joint are obliquely porrected, so that the rays form four series instead of all being on the same plane; the six apical joints minute and not producing rays. The antennæ of the female are setaceous, the rays being scarcely visible without a lens. The palpi are flattened, short and deflexed.

Sp. 5. SATURNIA HERSILIA, Westw. *S. alis maris integris flavis fusco subirroratis, striga angulata transversa ante medium alteraque ante apicem subundata fuscis; ocello magno mediano vitreo iride lata obscure lutea, linea tenui circulari nigra circumdata; alis posticis basi roseo-flavis, ocello maximo mediano vitreo circulari concentricis obscure luteo, nigro, late rufo, et albo cincto, strigaeque subapicali subundata fusca.*

Expans. alar. antic. unc. 5.

Hab. Congo. In Mus. Britann.

Male with the fore-wings entire, and slightly rounded along the outer margin. General colour yellow; fore-wings finely powdered with small brown scales, having a slender, angulated, brown striga before the middle, slightly tinged on the outside with rosy; in the middle of the wing is a large eye, having a subovate vitreous centre, surrounded by a broad dirty luteous brown ring, succeeded by a narrow black circle with a white outer ring; halfway between this and the outer margin is a narrow brown striga parallel with the outer margin, inwardly edged with rosy white. Hind-wings rosy yellow at

the base, near which is an oblique, very pale brown striga; followed by a very large eye with an oval glassy centre, surrounded by a broad dirty luteous brown ring, and this by a narrow black circle: this is succeeded by a broad red ring, and this by a white one, the adjoining space being rosy buff: between the eye and the apical margin is a subundulated blackish striga, edged internally with white. The fore-wings beneath want the anterior, angulated, brown striga; the ocellus is coloured as on the upper side, and the hind-wings are fulvous yellow, with the ocellus smaller than above, the black ring being surrounded by a white one, and this by a narrow rosy one; the white waved subapical striga is also narrowly bordered within with rosy.

Antennæ of the male chestnut-yellow, rather broad and flat, with forty-eight rays on each side, the two apical rays being very short, four rays being produced from each joint.

Body entirely orange-yellow, the outside of the tibiæ and tarsi blackish.

Sp. 6. SATURNIA MENIPPE, Westw. *S. alis integris testaceo-rufis apicibus fuscis, striga curvata ante alteraque pone medium angustis albis, communibus, alis omnibus ocello nigro (medio subvitreo) iride alba.*

Expans. alar. antic. unc. $5\frac{1}{3}$.

Hab. Port Natal et Africa Austral. In Mus. Brit. et Hope.

Fore-wings of the male entire and slightly rounded along the outer margin. Wings rich testaceous red; fore-wings with the costa pale buff-brown, base carmine-red, having a white slightly curved fascia running across all the wings, each of which is also marked in the middle with an equal-sized oval eye; the centre vitreous, but clothed with black scales, surrounded by a broad black ring, and this by a rather broad white one; this eye is followed by a uniform white bar, nearly parallel with the outer margin, which is rather dull buff, finely irrorated with brown scales; fringe dull buff. Wings beneath greenish buff, the anterior with the eye nearly similar to that of the upper side, followed by a white streak edged outwardly with black, and with a grey triangular patch near the tip of the wing, the outer margin somewhat paler, the middle dotted with brown. Hind-wings buff-white, irregularly clouded with dirty buff; across the middle is a nearly straight brown fascia, the apical half of the wing darker buff-brown, with two large lilac-grey spots, one near the anal angle, and the other towards the outer angle.

Antennæ dark brown; those of the male rather broad, with fifty-two joints in each, and about 100 rays on each side, extending consequently nearly to the extreme tip. Female antennæ nearly resembling those of the male.

Thorax dark carmine-red, brown in front, with a narrow white collar. Abdomen and under side of the body pale whitish buff. Head and legs pale buff-brown.

Sp. 7. SATURNIA TYRRHEA, Cramer. *S. alis griseis nigro irroratis; anticis striga ante medium alba valde dentata; omnibus*

ocello mediano (majori in alis posticis) vitreo, iride griseo-fulva annulis concentricis nigro, fulvo et albo circumcincta; omnibus etiam striga versus marginem duplicata undata communi.

Expans. alar. antic. fere unc. $5\frac{1}{2}$.

Syn. *Phalæna Tyrrhea*, Cram. Ins. 4. tab. 46. fig. A. *Bombyx Tyrrhea*, Fabricius, Ent. Syst. iii. part i. p. 415.

Hab. Cap. Bon. Spei et Africa australi. In Mus. Britann.

The antennæ of the male are moderately broad and flat, with fifty-two rays on each side; the four or five terminal joints very short, and not producing any rays; the rays are for the most part of nearly equal length, so that the broad part of the antennæ has its sides nearly parallel.

The antennæ of the female are compressed, and with scarcely any rudiment of pectinations.

The palpi are distinct, but very short.

The outer margin of the fore-wings of the female is entire.

Sp. 8. SATURNIA CYTHEREA, Fabr. *S. alis anticis margine externo parum emarginato; griseis, strigis duabus albis, anteriore undata, omnibus ocello magno (in alis posticis majori) vitreo; parte vitrea in anticis magna ovali, in posticis parva rotundata; iride flava, annulo nigro alteroque albo circumdata.*

Expans. alar. antic. individui typici Banksiani unc. $6\frac{1}{8}$; individ. in Mus. Brit. unc. 5.

Syn. *Bombyx Cytherea*, Fabr. Ent. Syst. iii. a. p. 410. *Echidna communiformis Cytherea*, Hübner, Auss. Sch. F. 3, 4. *Phalæna Capensis*, Cramer, Ins. tab. 302. fig. A, B; tab. 325. fig. G (♀), (nec *Phalæna Capensis*, Linn.). Sulz. Hist. Ins. tab. 21. fig. 1.

Hab. apud Cap. Bon. Spei.

In Mus. Banks. (Soc. Linn. Lond.) et Britann.

The male antennæ are moderately broad, with 126 rays on each side, affixed obliquely, the joints being very short, the ten terminal joints very short, with only one ray on each side, gradually diminishing in size.

The female antennæ are slightly serrated, each joint emitting two oblique serrations on each side, the basal pair being the largest, the size of the serrations gradually diminishing to the tip.

The palpi are short and broad, but do not extend beyond the hairs of the face.

I have seen a variety from the Zoolu country much varied with yellow, especially on the thorax, at the base of the wings, and along the apical portion beyond the subapical striga.

Sp. 9. SATURNIA DIONE, Fabr. *S. alis sulphureo-flavis, anticis in mare parum falcatis, strigis duabus, anteriore antice recta, postice dentata carnea, posteriore (communi) recta obscuriore, anticis etiam plaga albo-carnea basali alteraque versus apicem costæ nubilaque lata undata pone strigam externam griseo-carneis, omnibus in medio ocello (in alis posticis majori), pupilla minuta vitrea, iride fulva annulis nigro, albo carneoque circumcincta.*

Expans. alar. antic. unc. $5-5\frac{1}{2}$.

Syn. *Phalæna Guineensis flava perelegans*, Petiver, Gazoph. pl. 29. fig. 3. c. 478. *Bombyx Dione*, Fabr. Ent. Syst. iii. a. p. 410. *Phalæna Paphia*, Linn. (*ex parte*).

Hab. Congo, Ashantee (Mus. Brit.), Sierra Leone (Mus. Hope).

The fore-wings in the female are not so subfalcate as in the male, but the apical margin is slightly emarginate. The male antennæ are rather broad and flat, with forty-four rays on each side, four being emitted from each joint; about six of the terminal joints are furnished only with short, gradually diminishing spurs. The female antennæ are almost filiform. The palpi are short, but distinct and deflexed.

The nomenclature of this species is involved in some difficulty. Old Petiver rightly figured it as above referred to, under the name of *Phalæna Guineensis flava perelegans et pulchre oculata*. Linnæus, in the 10th edition of the 'Systema Naturæ' (p. 496), described an insect under the name of *Bombyx Paphia*, thus: "*P. Bombyx elinguis flava alis patulis falcatis concoloribus ocello fenestratis*. M. L. U.," thus indicating that the typical specimen of his species was contained in the museum of the Queen of Sweden. But Linnæus referred not only to Petiver's figure, but also, in the second place, to Catesby's 'Carolina,' ii. p. 91. t. 91, where is represented an insect described by Catesby as "*Phalæna ingens Caroliniana oculata e luteo fusca lineis dilute purpureis insignita*," which Cramer and Fabricius subsequently figured and described under the name of *Polyphemus*. Linnæus however, in this 10th edition of the 'Systema Naturæ,' gave to his *B. Paphia* the "*Habitat in Guineâ*."

In his 'Museum Ludovicæ Ulricæ,' Linnæus however treated his *B. Paphia* in a different manner. Without altering his specific character, he refers in the first place to Catesby's 'Carolina' (*S. Polyphemus*); 2ndly, with a query, to Petiver's *Phalæna Guineensis*; and 3rdly, to an insect figured by Rumphius in his 'Herbarium of Amboyna' (iii. t. 75), which, from the observation of Rumphius, "*Folliculus est Eruce Bengalensis Tesser vocatæ*," is evidently the Tusseh silk moth of Roxburgh (*S. Paphia*), thus confounding three American, African and Indian species under one name. He moreover in this work gives the "*Habitat in Americâ Septentrionali*," and his detailed description evidently proves that he had the American species of Catesby in view in proposing the name of *Paphia*; indeed his reference to the "M. L. U." in the 10th edition of the 'Systema Naturæ' likewise fully proves that, although giving in that work Guinea as the habitat of his *Paphia*, the American insect was the one before him.

But in the 12th edition of the 'Systema Naturæ,' we find Linnæus making the matter still more confused; for we now find the reference to Petiver restored to its first position, that to Catesby given with doubt, and the reference to Rumphius added in the third place, the locality being "*Habitat in Guineâ, Asia*."

Now if we are to regard the last work of an author as containing his matured opinions, and allow him at the same time the right to modify his opinions to an extent involving the change of specific names, in the manner followed in this instance by Linnæus (which is however a power which I deny that an author ought to possess), we must remove from the Carolina species all right to the name of *Paphia*

and confer it on the African insect; but I contend that as Linnæus clearly defined the American species under that name in the 'Museum Ludov. Ulr.,' and in his subsequent work made no attempt to discriminate the three species, we are warranted, 1st, in retaining the name of *Paphia* for the American insect, in which case it will be necessary to sink the Fabrician name of *Polyphemus* into a synonym of *Paphia*; 2ndly, in giving to the African one the Fabrician name of *Dione* (striking out the incorrect Fabrician reference of Petiver's Guinea insect to the Asiatic species); and 3rdly, in giving a different specific name to the Tusseh silk moth of India, to which Fabricius restricted the name of *S. Paphia*, but which it ought certainly not to retain, seeing that Linnæus, when he first proposed that name, knew only the African and American insects. Drury has however enabled us to clear up the difficulty as to this third species, having figured it in the second volume of his 'Illustrations' under the name of *Mylytta* (pl. 5. fig. 1 = *Paphia*, Cramer. Ins. 13. tab. 147. fig. A), which name Fabricius also adopted, giving the Asiatic species twice over under the names of *Paphia* and *Mylytta*.

The synonyms of the three species will stand thus:—

1. *Saturnia Paphia*, Linn. Mus. Lud. Ulr.
B. Polyphemus, Fabr.
Hab. North America.
2. *Saturnia Dione*, Fabricius.
Phalæna Guineensis, Petiver.
Ph. Paphia, Linn. Syst. Nat., ed. 10. *ex parte*.
B. Petiveri, Guérin, Ann. Soc. Sericicole.
Hab. Africa.
3. *Saturnia Mylytta*, Drury, Fabr.
B. Paphia, Cramer, Fabricius.
The Tusseh Silkworm Moth.
Hab. India.

SATURNIA WAHLBERGII, Boisduval in Delegorgue, Voy. dans l'Afr. Austr. ii. p. 600.

Of this supposed species, which inhabits Port Natal, I have seen specimens, but I cannot consider them distinct from *S. Dione*, of which they are highly coloured individuals. The following is M. Boisduval's description:—

“Elle est un peu plus grande que la *Saturnia Pyri* d'Europe, et son port est assez différent. Le dessus des quatre ailes est jaune, fortement saupoudré d'atomes bruns avec une bande étroite, brune doublée intérieurement de gris violâtre commune régulière; commençant près du sommet des supérieures et arrivant au bord interne des inférieures, juste au niveau de l'extrémité de l'abdomen. Vers le base des quatre ailes on voit une autre bande commune très-sinueuse irrégulière, violâtre précédé à la base des supérieures d'une espèce détaché de sa couleur. L'œil des ailes supérieures est petit, transparent, cerclé de jaune et entouré d'un peu de violâtre surtout dans le mâle; l'œil des ailes inférieures est plus grand, jaune, à prunelle diaphane et à iris noir cerclé de violet. Dédié à M. Wahlberg, l'un des compagnons de M. Delegorgue.”

In addition to the above characters, it may be noticed, that the bar beyond the middle of the wings is slender, grey, outwardly edged with a dusky line, and inwardly with purplish brown; outside the bar is a series of large, triangular, lilac-white patches united together, and the disc of the wings, especially towards the base, is much more irrorated with lilac-pink.

Sp. 10. SATURNIA APOLLONIA, Cramer, Ins. vol. iii. pl. 250 A.

S. alis pallide fuscis albo flavoque variis; anticis fascia subapicali flava extus fusca; alis posticis albis strigis duabus fuscis pone medium, exteriore flavo intus marginata; omnibus ocello nigro in medio subviride iride alba; in anticis etiam annulo flavo cincto: corpore albo thorace macula media fusca.

Expans. alar. antic. unc. $3\frac{3}{4}$.

Hab. Caput Bon. Spei et apud Portum Natalensem.

The antennæ are fulvous and short; the pectinations forming an elongate ovate outline, pointed at the tip, with only thirty-eight rays on each side, four being emitted from each joint. The rays lie flat, and several of the terminal joints are destitute of rays. The female antennæ are 24-jointed, the pectinations forming a much narrower oval outline than in the male; the pectinations of the basal part being short, each joint emitting four rays, of which the apical pair is not above half the length of the basal ones.

This species is well-figured in Mr. Angas's plate of Lepidoptera of the Zoolu country, fig. 14.

Subsection B. b.

Sp. 11. SATURNIA MIMOSÆ, Boisduval (Voy. de Delegorgue dans l'Afrique Austr. p. 600). *S. alis glauco-viridibus, antillarum costa grisea linea vel striga undulata griseo-fusca paullo pone medium maculaque grisea ad angulum posticum; omnibus ocello æquali, flavo, iride tenui castanea anticeque lunula tenui grisea notata; posticis in caudam longissimam spatulatam basi griseo-fuscam, apice flavo-viridi productis.*

Expans. alar. antic. unc. $5\frac{1}{4}$, long. alar. postic. unc. $4\frac{1}{2}$.

Hab. apud Portum Natalensem. In Mus. Britann. &c.

This species belongs to the subgenus *Actias* of Leach, and is allied to *S. Selene* of India, *S. Luna* of North America, *S. Isis** of Java, *S. Cometes* of Madagascar, described by M. Boisduval in his 'Fauna of Madagascar,' (apparently identical with the species captured at Nosse Bé, on the east side of Madagascar, by M. Mitre, exhibited by M. Guérin at the Entomological Society of France (see Annales de la Soc. Ent. 1846, p. civ.); *S. Mænas* of Silhet (figured in my Cabinet of Orient. Entomol. pl. 22), and *S. Leto*, Doubleday, also from Silhet (figured in the Trans. of the Entomol. Soc. vol. v. pl. 15. A very fine specimen of this last-named insect, with the markings on the wings much more distinct, is contained in the Ashmolean Museum at Oxford).

* This very rare species, of which M. Boisduval was acquainted with only a single specimen in the collection of M. Robyns of Brussels, will require a new specific name to distinguish it from the *S. Isis* of this monograph.

The wings of *S. Mimosæ* are pale yellowish-green with the apical margin waved, that of the fore-wings of the male being somewhat more emarginate than in the female. The costa of the fore-wings is broadly purplish-grey, much-irrorated with white; beyond the middle arises on the costa an oblique dark chestnut spot, which emits an undulating line across the wing (which forms a waved fascia in the female), and near the tip of the wing the pale costa is separated from the green ground by a dark chestnut dash. In both sexes the anal angle of the fore-wings is occupied by a grey-brown patch which extends narrowly into the wing parallel with the outer margin; the incisures of all the wings are tinged with chestnut-purple; from the middle of the pale costa of the fore-wings arises a purplish-brown spot to which is attached the ocellus, which is rather small, oval and transverse; the centre formed of a small glassy spot surrounded by fleshy-brown and this by yellow, more orange-coloured on the side towards the base of the wings, where it is also surmounted by a black-brown lunule powdered with white scales along its middle. The hind-wings are more uniformly green above, with an ocellus similar to that of the fore-wings, the anal angle produced into a slender tail longer than the body of the wing and spatulated at its extremity; this tail is chestnut-brown throughout its narrow part, where it is much-powdered with white, the dilated apical part being green. The body is yellow and the antennæ are fulvous.

The underside resembles the upper, except that the undulating line beyond the middle of the wing is wanting, and is replaced by a similar one nearer to the outer margin of the wing, and running along the hind-wings.

The underside of the abdomen is marked with purple spots along the apical margin of the segments. The antennæ of the males are very broad, emitting 50 rays on each side, the five or six terminal joints with very short rays. The rays on each side of each joint arise at a little distance from the base and extremity of each joint, so that there is a more decided space between the second ray of one joint and the first ray of the next joint than usual.

The veins of the fore-wings are arranged as in the typical *Saturniæ*, and those of the hind-wings as in *S. Mænas* (as exhibited in my figure above referred to) and as in *S. Luna*, the peculiarity in the subgeneric group *Actias* of Leach containing the above-named species, being that the three branches of the median vein of the hind-wings are compressed closely together, arising on the inside of the ocellus and extending into the long tail, a transverse vein running across the middle of the ocellus, closing the discoidal cell, and uniting the inner branch of the post-costal vein with the outer branch of the median vein.

Boisduval informs us that this species "est très commune à quatre à cinq lieues dans l'intérieur du pays sur les Mimosas. Les cafres se servent du cocon qui est très-gros et très-solide pour se faire des tabatières. Pour cela ils y font un trou pour extraire la chrysalide, et ils le bouchent ensuite avec une cheville de bois."

A beautiful figure of this species is given by Mr. Angas in his plate of Zoolu Moths, fig. 18.

This is evidently the species alluded to in the following note, published by M. Signoret in the Journal of the Proceedings of the Entomological Society of France, Annales 1845, p. xevii:—"M. V. Signoret présente à la Société un dessin d'une nouvelle espèce appartenant au genre *Saturnia*, et il communique une note à ce sujet. M. V. Signoret dit que le Chenille de cette espèce est inconnue, que les chrysalides en furent trouvées en Novembre 1844, sur un Mimosa près de la rivière Toogela, limite des frontières du royaume Aucayoolao, situé entre Lugoo-Baie et Port-Natal: l'insecte parfait a été rapporté par M. Campion de Douai, et notre collègue propose à la Société de lui appliquer le nom de *Saturnia Campionea*."

Sp. 12. SATURNIA ARGUS, Fabr. *S. omnibus pallide carneo-albidis, anticis margine postico rotundatis, disco punctis sex in medio approximatis, fenestratis, annulo, fulvo nigroque cinetis; posticis punctis quinque sparsis ejusdem coloris; margine anali in caudam longissimam extenso.*

Expans. alar. antic. unc. 3, long. alar. postic. unc. 4.

Hab. the Isle of Bauana (Smeathmann).

In Mus. Britann., Banks. (Linn. Soc.), Westwood, &c.

Syn. *Bombyx Argus*, Fabr. Ent. Syst. 111 a. p. 414; Stoll, 27. 1; Donovan. Nat. Repos. 5. 173; Oliv. Enc. Meth. 5. 29. 22; Drury, Ent. vol. iii. pl. 29. fig. 1. *Phalæna brachyura*, Cramer, Ins. pl. 29. fig. 1. *Eudæmonia Uroarge*, Hübner, Verz. No. 1586.

The fore-wings are considerably rounded along the apical margin, and the tails of the hind-wings are much longer in proportion than in *Mimosa*, *Luna*, &c. The veins of the fore-wings are similarly arranged to those of *S. Mimosa*, &c., but those of the hind-wings are peculiar in having the veinlet which connects the inner branch of the post-costal vein and the outer branch of the median vein closing the discoidal cell so oblique (as well as subangulated in the middle), that it seems like a real fourth branch of the post-costal, running down within the outer margin of the tail, the base of the outer branch of the median vein being so thin and short that it resembles the ordinary condition of the veinlet closing the cell, although its nearly longitudinal direction indicates its real nature as a branch of the median vein*.

The antennæ of the females (I have seen no male) are 26-jointed, each joint after the second producing only a pair of rays, arising close to the base of the joint. The palpi are also as long as the head and deflexed, with the terminal joint long and pendulous. In these respects it will be necessary to separate this insect at least subgenerically from the other *Saturniæ*; it may therefore be advisable to use Hübner's subgeneric name *Eudæmonia* for it.

* *Saturnia (Eudæmonia) Semiramis*, Cramer, pl. 13 A, differs materially in the veining of its wings from *S. Argus*. In the fore-wings the inner branch of the post-costal vein, instead of arising from the preceding branch in an acute fork, as in the typical *Saturniæ*, arises from the middle of the transverse vein closing the discoidal cell, whilst in the hind-wings the inner branch of the post-costal vein runs within the outer edge of the tail throughout its whole length, the first branch of the median vein arising nearly opposite to the base of the tail, and the second branch at some length down the tail.

BOTANICAL SOCIETY OF EDINBURGH.

Feb. 14, 1850.—Professor Fleming, in the Chair.

Mr. McNab exhibited the flowering rachis with terminal bracts of the red-fruited variety of *Musa sapientum*, and stated that the plant in the Botanic Garden was received from Mr. Lockhart, Botanic Garden, Trinidad, during the year 1842. It had frequently ripened its fruit in the Botanic Garden at Edinburgh. The plant which produced the rachis shown was only twenty months from the sucker state when it first showed its fruit in May 1849. It continued to ripen gradually till the end of December, when a few of the first, or best ripened of the fruits, were gathered. The rachis, from the point to its insertion into the plant, was 6 feet long, and produced five matured clusters averaging 8–9 lbs. each in weight, and each having fifteen perfect and well swelled fruits. Besides the five perfect clusters, it had two imperfect ones, with fifteen immature fruits, varying from 1 to 3 inches long. The fruiting plant is 14 ft. 6 in. in height above the tub, exclusive of its leaves, which are 10 ft. long and 2 ft. 6 in. broad; the stem is 35 inches in circumference at its base. The weight of the head of fruit, when in its perfect state, was estimated at from 75 lbs. to 80 lbs. The plant is one of the largest in cultivation, and also one of the most prolific, the fruit ripening successively over a period of two months.

Mr. McNab made the following report of plants in flower in the Botanic Garden, &c. :—

Feb. 8. *Rhododendron dauricum* in flower, sparingly, in Botanic Garden.

- 9. *Eranthis hyemalis* in flower in Dr. Neill's Garden.
- 11. *Galanthus nivalis* in flower in Botanic Garden—*Gentiana verna* flowering in a cold frame in Dr. Neill's Garden.
- 14. *Galanthus plicatus* in flower in Botanic Garden.
- 14. *Tussilago fragrans*, *Helleborus foetidus*, *Primula veris*, *P. vulgaris*, *Eranthis hyemalis*, *Garrya elliptica*, *Arbutus Unedo*, *Viburnum Tinus*, *Cydonia japonica*, and cultivated varieties of *Viola tricolor*, in flower in Botanic Garden.
- 14. *Helleborus odoratus* and *H. atro-purpureus* in flower in Experimental Garden.
- 14. *Hepatica triloba* and *Corylus Avellana* in flower in Dr. Neill's Garden.

The following papers were read :—

- 1. "Notice of some of the rare Plants observed in Orkney during the Summer of 1849," by John T. Syme, Esq. (See p. 266.)
- 2. "On the Embryogeny of *Hippuris vulgaris*," by John Scott Sanderson, Esq. (See p. 259.)
- 3. "Account of an Excursion from Simla to the Burenda Pass, and other parts of the Himalaya, in July and August 1847," by Lieutenant Robert Maclagan, Bengal Engineers, Principal of the College of Civil Engineers, Roorkee, North-West Provinces of India. The author of this paper left Simla on the 10th of July 1847, and

proceeded to Nagkhunda; thence he visited the hill called Whartoo or Huttoo, and followed the valley of the Pubhur. A general account was given of the vegetation of the district, and remarks made on its geological features, natural scenery, and the modes of travelling through it. The summit of the Burenda Pass was reached on the 21st. The elevation of the pass was found, on a rough estimate, to be 15,263 feet above the level of the sea. Goitre was noticed as prevalent among the inhabitants of these regions. The village of Booroon was visited. It is situated about 1500 feet above the river Buspa, near its confluence with the Sutlej. Vineyards were common in this district (which receives the name of *Koonawur*), and apricots are abundantly cultivated, both on account of their fruit and the oil which is obtained from the kernels. From Booroon Mr. MacLagan ascended the river Sutlej to Pooaree and Zginam; and, after crossing a hill called Skerung, reached Nesung. He subsequently ascended the Sutlej to Namja, a village close to the Chinese frontier. He described the general features of the Tartars, their dress and habits; and also noticed the shawl goat and the yak (*Bos grunniens*). Leaving Namja he reached the Chinese village of Shipkee, and afterwards passed through Keookh without interruption, following the Sutlej as far as the junction of two roads, one leading to Garoo and the other to Chapnung. From this point he returned to Shipkee and Namja, and thence followed the Spiti to Shalkur, a so-called fort in lat. 32° , long. $78^{\circ} 30'$. He crossed the Lapcha Pass, which is about 13,800 ft. above the level of the sea, and rested at Dunker on the 14th August. The fossil locality near Geoongool was examined. The Tarce Pass was ascended on the 16th. This pass is, on a rough calculation, about 16,000 feet above the level of the sea. On the summit of the Pass at sunrise the thermometer stood at 35° Fahr. After crossing the pass, the author journeyed by Rampoor to Simla, which he reached on 1st September 1847. The plants met with during the route were noticed, and specimens of several of them were exhibited at the meeting. The following is a list of the natural orders to which the plants observed during the trip belonged, with the names of the genera and of the species, so far as they were ascertained:—

Ranunculaceæ.—*Ranunculus*, *Delphinium velutinum*, and another species; *Anemone*, two species; *Aquilegia glauca*, *Clematis graveolens*.

Papaveraceæ.—*Meconopsis aculeata*.

Cruciferae.—*Erysimum* like *E. cheiranthoides*, *Sisymbrium*, *Draba*.

Capparidaceæ.—*Capparis*.

Tamaricaceæ.—*Tamarix*.

Caryophyllaceæ.—*Stellaria*, two species; *Silene*, a species very like *S. italica*; *Cerastium*; *Dianthus*, two species; *Sagina*, *Lychnis*, *Spargula*, &c.

Malvaceæ.—*Sida*.

Sapindaceæ.—*Æsculus*.

Geraniaceæ.—*Geranium*, three species; *Erodium*.

Oxalidaceæ.—*Oxalis corniculata*.

Leguminosæ.—*Lotus corniculatus*, *Lespedeza juncea*?

- Rosaceæ*.—*Rosa* tetrapetala and another species, *Potentilla atrosanguinea*, *P. nepalensis* and two others, *Spiræa vacciniifolia*, *S. Lindleyana*, *Sibbaldia purpurea*, *Fragaria vesca*, *Agrimonia nepalensis*, *Armeniaca vulgaris*.
- Onagraceæ*.—*Epilobium laxum*, *E. angustifolium* var., and another species.
- Crassulaceæ*.—*Sempervivum*, and another genus.
- Grossulariaceæ*.—*Ribes glacialis* and another species.
- Umbelliferaæ*.—*Hymenolæna*, *Pycnocycla glauca*, *Chærophyllum*, *Bupleurum*, and *Myrrhis*?
- Rubiaceæ*.—*Asperula odorata*?, *Galium*, and another undetermined.
- Compositæ*.—*Aster*, *Erigeron* like *E. alpinus*; *Gnaphalium*, two species; *Antennaria*, *Scorzonera*; *Achillæa*, two species; *Artemisia*, *Calameris Doronicum*, *Prenanthes*, *Senecio*, and two other genera.
- Vacciniaceæ*.—*Vaccinium*.
- Aquifoliaceæ*.—*Ilex*.
- Jasminaceæ*.—*Jasminum*.
- Oleaceæ*.—*Fraxinus* like *F. xanthoxyloides*.
- Gentianaceæ*.—*Gentiana*, three species, and another genus.
- Polemoniaceæ*.—*Polemonium cæruleum*.
- Convolvulaceæ*.—*Ipomæa*.
- Boraginaceæ*.—*Myosotis*, two species; *Echinospermum*?, *Anchusa tinctoria*.
- Scrophulariaceæ*.—*Veronica*; *Pedicularis*, two species; and *Euphrasia officinalis*.
- Labiataæ*.—*Acinos*, *Calamintha*, *Salvia*, *Prunella* like *P. vulgaris*, *Colquhounia vestita*? and other two genera, one of which is like *Hyssopus*.
- Verbenaceæ*.—*Verbena* like *V. officinalis*.
- Acanthaceæ*.—*Morina longifolia*, and a genus like *Justicia*.
- Primulaceæ*.—*Androsace rotundifolia*.
- Plantaginaceæ*.—*Plantago*.
- Polygonaceæ*.—*Rumex* like *R. hastatus*, *Polygonum* like *P. Brunonis*, and another genus.
- Euphorbiaceæ*.—*Euphorbia cashmeriana*?
- Amentaceæ*.—*Betula*, *Fagus*.
- Juglandaceæ*.—*Juglans*.
- Coniferaæ*.—*Taxus baccata*?, *Pinus Neoza*, *Abies*, and a genus like *Callitris*.
- Orchidaceæ*.—*Orchis*.
- Zingiberaceæ*.—*Roscoea alpina*?
- Liliaceæ*.—*Lloydia Kunawurensis*?
- Cyperaceæ*.—*Carex*; *Cyperus*, two species, one of which is like *C. muricata*.
- Gramineæ*.—*Phalaris*, *Alopecurus pratensis*; *Bromus* (like *B. erectus*); *Milium*, two species; *Phleum*, two species; *Poa*, one like *P. annua*; *Setaria*, *Triticum*, *Stipa* like *S. pennata*, and *Dactylis glauca*.
- Filices*.—*Adiantum Capillus-Veneris*, and others.

MISCELLANEOUS.

Descriptions of new species of Birds of the Family Caprimulgidæ.

By JOHN CASSIN.

Genus *HYDROPSALIS*, Wagler, Isis 1832, page 1222.

1. *Hydropsalis limbatus*, nobis.

Adult ♂? Form.—Wings long, pointed, with the shafts of the primaries strong and slightly curved; first primary longest, second and third deeply sinuated on their outer webs, and, with the first, having their external margins distinctly serrated. Tail excessively long, graduated, the two external feathers surpassing the next by about 14 inches; others regularly receding to the two in the middle which are shortest. Tarsi feathered slightly below the knee. Webs of outer tail-feathers narrow.

Dimensions.—Total length of skin, from the tip of bill to end of tail, about 2 feet 5 inches; of the wing 9 inches; of the tail to end of external feathers about 22 inches; length of two middle tail-feathers about 3 inches.

Colours.—Upper surface of the head, body and wing-coverts brownish black, spotted and sparingly lined with pale fulvous. The wing-coverts with round spots at their points of the same colour.

Superciliary region grayish white, every feather having narrow irregular lines of black. Hind-neck with a semi-collar of bright reddish fulvous. Under the eye an irregular whitish stripe.

Scapular feathers with their external webs black, with a few curved lines of fulvous remote from the tip, which is broadly margined with black; internal webs of scapulars nearly white, irregularly striped and spotted with black; other scapulars nearly black, with pale fulvous margins externally.

Throat before with a white collar. Chin, breast and belly irregularly mixed with brownish black and pale yellowish white, the latter colour assuming upon the breast the form of semicircular segments and lunular spots upon the tips of the feathers, and the former (blackish) disposed to form very irregular narrow bands upon the flanks and belly; ventral region and under tail-coverts paler.

Quills brownish black, having upon their internal webs four or five narrow transverse lines of pale yellowish white, conspicuous when viewed from below; and upon their external webs (except the first) several rounded or irregular-shaped spots of the same colour. Second and third quills where sinuated upon their outer webs, with a very slight margin of white. Secondaries obscurely tipped with whitish.

First, second and third tail-feathers throughout their whole length with their outer webs and about two-thirds of their inner webs brownish black; other portion of the inner webs, being the internal margin of those feathers, white; a few bright fulvous spots near the base upon the outer webs. Fourth and fifth tail-feathers with similar colours, but more broadly bordered with white, which upon those, as well as the third, is sparingly spotted with brownish.

Young ♀? *Form.*—Tail deeply emarginate, but not excessively long; external feathers exceeding the next by about $1\frac{1}{2}$ inch only.

Dimensions.—Total length of skin, from tip of bill to end of tail, about 12 inches; wing 8 inches; tail to end of external feathers $7\frac{1}{2}$ inches; length of middle tail-feathers about $3\frac{1}{2}$ inches.

Colours.—Entire upper surface, tail included, brownish black, with numerous rounded spots and lines of reddish fulvous, assuming upon the tail the form of irregular or curved bands, which are more or less mottled and mixed with the brownish black of the other predominating portion. Throat with a semi-collar of yellowish white. Entire under-parts brownish black, banded and spotted with fulvous.

Hab. South America.

Obs.—This very remarkable species may readily be distinguished by its very long forked tail, the feathers of which are irregularly graduated. In the latter respect it differs from the *Hyd. psalurus* (Temm.), to which however it bears but little resemblance.

There are in the collection of the Academy three specimens of this species, two males in the Rivoli collection, and a female which was fortunately procured in Paris by Mr. Edward Wilson.

2. *Hydropsalis segmentatus*, nobis.

♂ *middle age?* *Form*.—Wings moderate, second primary slightly longest, second, third and fourth deeply sinuated on their outer webs; first with its outer edge serrated, inner edges (of primaries) presenting a fringed appearance. Shafts of primary quills strong and curved.

Tail very long, the two external feathers of which surpass the next by about 10 to 12 inches; second, third and fourth graduated; fourth and fifth about equal—that is to say, the four middle feathers of the tail nearly equal.

Bill rather long and slender. Tarsi bare, slender. Webs of outer tail-feathers very narrow.

Dimensions.—Total length of skin, from tip of bill to end of tail, about 20 inches; wing $6\frac{3}{4}$; tail to end of external feathers about $15\frac{1}{2}$ inches; length of four middle tail-feathers about 4 inches.

Colours.—Upper surface of head, body, scapulars and wing-coverts brownish black, spotted and obscurely lined with ferruginous rufous, which colour almost predominates upon the scapulars.

Neck, behind, with an obscure ferruginous semi-collar; before, with a semi-collar of rufous white. Body beneath brownish black, with rounded ferruginous spots upon the breast, and upon the belly with obscure bands and spots of pale ferruginous and nearly white.

Wing-feathers brownish black; first primary with a narrow pale reddish border upon its outer web for about half its length, second and third with a pale ferruginous spot at the point of situation. Secondaries with irregular bars of reddish and with narrow tips of the same colour.

The two external feathers of the tail with their shafts white upon the upper surface, outer webs white tinged with rufous, and handsomely marked (upon the outer webs) with semicircular segments of black, having for their bases the shaft of the feather. This marking is more conspicuous towards the base, and upon the under surface the black colour of these semicircular segments extends to the shaft of the feather. All the other tail-feathers brownish black, with bars

of ferruginous rufous ; upon the two middle feathers these bars are mottled with black.

Young ♀ ? Form.—Tail ample, emarginate, and regularly graduated, the two external feathers being but little longer than the second.

Dimensions.—Total length of skin, from tip of bill to end of tail, about 9 inches ; wing $6\frac{1}{4}$; tail to end of external feathers about 5 inches ; length of middle feathers of the tail about 4 inches.

Colours.—Entire plumage very similar to the male, but with all the tail-feathers brownish black, barred with ferruginous.

Hab. Bogota, New Grenada.

Obs.—The two specimens now described belong to the Rivoli collection, and have the appearance of being either young birds, or with the plumage of winter. The male may, however, be easily recognized by the curious marks upon the external webs of the outer tail-feathers, described above. The colours in the present specimens, black and ferruginous, are peculiar to this species, so far as I have seen.

GENUS ANTROSTOMUS, Gould.

3. *Antrostomus serico-caudatus*, nobis.

Adult ♂ Form.—Wings rather long, third primary longest ; second, third and fourth sinuated on their outer webs ; shafts slightly curved. Tail cuneiform, four middle feathers equal and longest.

Bill rather long and flat ; tarsi short, slightly feathered below the knee.

Dimensions.—Total length of skin, from tip of bill to end of tail, about 11 inches ; wing $7\frac{1}{4}$; tail $5\frac{3}{4}$ inches.

Colours.—Head above, back, rump, scapulars and wing-coverts variegated with black and dark fulvous, the latter in rounded spots and narrow irregular lines, predominating upon the wing-coverts, but the former (black) upon the head and scapulars. This colour disposed to form a broad longitudinal band on the head. Sides of the head, over the eyes, grayish ; every feather with transverse black lines. Neck behind with a semi-collar of deep reddish fulvous ; before with a semi-collar of yellowish white, the feathers of which are tipped with black.

Throat nearly black ; breast below the collar with deep fulvous spots and irregular lines ; belly and ventral region with a predominating pale fulvous white, and some nearly pure white spots, every feather transversely lined and barred with black ; under tail-coverts fulvous, unspotted.

Wing-feathers brownish black ; primaries with about ten to twelve irregular-shaped but rather triangular marks of deep fulvous upon their external webs ; secondaries with irregular bars of pale fulvous, which bars are mottled with black.

First, second and third feathers of the tail brownish black, with several obscure and badly defined bands of reddish fulvous, and obliquely tipped in a very conspicuous manner with fine, silky white. Fourth feather of similar colour, but without the white tip, and with the reddish fulvous bands more definite. Two middle tail-feathers brownish black, and with about ten to twelve bars on each web of deep reddish fulvous, well defined, and which are disposed obliquely

from the shafts of the feathers like a pinnate leaf; those bars broad and mottled with black; two middle feathers without white tips.

Younger? form.—As above described, but with the second primary slightly the longest.

Dimensions.—Total length of skin, from tip of bill to end of tail, about $10\frac{1}{2}$ inches; wing $7\frac{1}{4}$; tail $5\frac{1}{2}$ inches.

Colours.—Very similar to the above, but with the grayish colour extending over the whole of the head. Under parts much darker, but with more numerous white rounded spots. Under tail-coverts fulvous with black lines. The fine white tips of the external tail-feathers tinged with fulvous.

Hab. South America.

Obs.—The distribution of the colours upon the upper surface of the body, in this handsome species, resembles in some degree that of *Scolopax rusticola*, or of *S. minor*.

It is not similar to any other species known to me, and can at once be recognized by the silky white tips of the external tail-feathers. These cross the feathers obliquely, and are so arranged that when the cuneiform tail is expanded, they form a continuous margin upon the ends of those three feathers.

This is one of the few species of this family which have pretensions to beauty. Two specimens are in the collection of the Academy.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 236.

FORMER EXISTENCE OF GIGANTIC BEARS IN IRELAND.

To Richard Taylor, Esq.

Phil. Hall, Leeds, March 5, 1850.

MY DEAR SIR,—Having just read with much interest in the last number of the ‘Annals,’ my friend Dr. Ball’s announcement of the former existence of gigantic bears in Ireland, probably coexistent with Megaceros, together with Professor Owen’s valuable remarks on the same, it appeared to me that a ray of light is thrown on this question in one of Archdeacon Maunsell’s letters respecting the gigantic deer, found at Rathcannon, and now in the Museum of the Royal Dublin Society. It is addressed to Lord Viscount Northland, and dated Limerick, April 7th, 1824, in which, after describing the above noble skeleton, he says, “I have also a skull of a dog of a large kind (at least of a carnivorous animal), which I found lying close to some of the remains, and which I will transmit with the bones of his old acquaintance.”

Now, as Archdeacon Maunsell appears somewhat uncertain whether the said skull was really that of a *dog*, might it not have been that of the gigantic bear? If the identical specimen can still be traced and examined, after so many years, it might afford additional evidence upon so important a discovery.

Again, Professor Owen thinks it an interesting question to ascertain whether these ursine remains were contemporaneous with Megaceros or not, which could be decided by the relative antiquity of the formation in which they are found, *i. e.* peat or marl. Dr. Ball di-

stinctly says, the skulls contained fragments of the latter and none of the former; upon this point the Archdeacon also expressly states, "they were both found lying close together." If therefore the above skull eventually proves to be that of a bear, the period of its existence is decided to have been cœval with that of the *Megaceros*!

Believe me, my dear Sir, yours very truly,

HENRY DENNY, A.L.S.

On some new genera and species of Entozoa. By Dr. LEIDY.

1. *Ascaris cylindrica*. Body nearly cylindrical throughout, anteriorly moderately attenuated; tail curved, 1-214th of an inch in length from the anus; œsophagus elongated, gibbous in the middle, with the œsophageal bulb and pharynx 1-100th of an inch in length; œsophageal bulb pyriform, 1-75th of an inch in diameter; ventricle or intestine somewhat tortuous, cylindrical, dilated at both extremities; rectum pyriform; female generative aperture about half-way between the mouth and tail. Whole length 4-5th of a line, breadth 1-12th of a line.

Hab. Small intestine of *Helix alternata*.

Remarks.—I found the female only of this species in fifteen out of forty specimens of *Helix alternata*, in numbers of from one to three. The ovaries in all were distended with ova, the latter measuring 1-430th of an inch in length by 1-576th in breadth.

2. *Ascaris infecta*. *Female*.—Subcylindrical, gradually diminishing towards the extremities, white, with a brown streak down the lower two-thirds of the middle line; anteriorly obtusely rounded; tail slightly curved, 1-80th of an inch long from the anus. The three papillæ of the mouth projecting; œsophagus strongly muscular, thick, oblong, pyriform, 1-80th of an inch long, greatest breadth 1-175th of an inch; œsophageal bulb cordiform, 1-166th of an inch long by 1-166th of an inch broad; ventricle slightly dilated at commencement, contracted posteriorly; generative orifice projecting, just below the middle of the body; vagina furnished with a large ovate seminal receptacle.

Male.—Dilated at both extremities; tail thick, 1-174th of an inch long, furnished upon its inner aspect with two minute tubercles. Above the anus are two rows, each of four tubercles, connected by delicate folds of integument. Œsophagus 1-111th of an inch long by 1-260th of an inch broad; œsophageal bulb depressed cordiform, 1-214th of an inch long by 1-250th of an inch broad. Penis formed of two curved spiculæ, measuring in length, in a straight line, 1-78th of an inch.

Length of adult female 3 to $4\frac{1}{2}$ lines; breadth at origin of ventriculus 1-123rd of an inch; middle of body 1-83rd to 1-60th of an inch; just above anus 1-144th of an inch. Ova 1-319th of an inch long by 1-428th inch broad.

Length of male 2 lines; breadth at origin of ventriculus 1-176th of an inch; middle of body 1-211th of an inch; just above anus 1-202nd of an inch. Spermatophori oval, 1-1391 inch long by 1-1666th inch broad, with spermatozoa 1-3750th inch long by 1-10,000th inch broad.

Hab. This species is found in numbers of from three up to fifty or more, of various ages and sizes, pretty constantly in the small intestine of *Julus marginatus*, Say. The males are found in the proportion of about one in eight.

Aorurus, a new genus of *Nematoideæ*.—Body cylindrical, strongly annulated, with a tail nearly as long as the body, straight or nearly so, inflexible, spiculate, ensiform, shining, and pointed. Mouth unarmed. Female generative aperture near the middle of the body.

Remarks.—This genus is divisible, by several well-marked characters, into two distinct subgenera.

1st subgenus. Streptostoma.—Body cylindrical, very strongly marked with broad annuli. Mouth moderately large, round, bordered by a collar (formed by the second annulus projecting beyond the general outline of the body). Œsophagus divided into two distinct pyriform muscular bulbs, with a small intermediate rounded bulb. Tail four-fifths the length of the body.

Streptostoma agile. Female.—Body larviform, cylindrical, narrowed anteriorly and posteriorly, opalescent white, divided into from sixty-one to eighty-eight broad annulations, of which there are twenty-one from the mouth to the commencement of the ventriculus. Tail very straight, occasionally slightly sigmoid, or bent at the point, narrow and sharply pointed, inflexible and brittle. Mouth moderately large, round, projecting; pharynx almost null; œsophagus consisting of three bulbs: the first elongated pyriform, strongly muscular, measuring 1-197th in. long by 1-319th in. broad; second bulb small, rounded, muscular, 1-882nd in. long by 1-882nd in. broad; third, or true œsophageal bulb, pyriform, 1-294th in. long by 1-312th in. broad. Ventriculus dilated at commencement to nearly the diameter of the body, afterwards straight and cylindrical to near its termination, where it is slightly dilated. Rectum elongated, pyriform. Generative aperture situated about twenty-four rings above the anal aperture, which latter is placed between the last two annuli of the body. Ovary double; ova 1-333rd in. long by 1-400th in. broad.

Length of body from 1-13th to 1-11th inch; breadth at commencement of ventriculus 1-118th inch; at middle of body 1-97th inch. Tail from 1-16th to 1-15th inch long, by 1-888th in. broad at its middle.

2nd subgenus. Thelastoma.—Body cylindrical, attenuated anteriorly, strongly marked with moderately broad annuli. Mouth small, opening at the extremity of a small papilla. Œsophagus divided into two distinct portions, the first long and cylindrical, the second constituting the true œsophageal bulb. Tail more than half the length of the body.

Thelastoma attenuatum. Female.—Body attenuated anteriorly to commencement of the ventriculus, opalescent white, divided into from 140 to 160 annulations, of which there are from fifty-two to fifty-seven from the mouth to the commencement of the ventriculus. Tail very straight, or very slightly curved or bent, slender, inflexible and brittle, and sharply pointed. Mouth always projected, small, surmounting a small papillary elevation formed by the first annulus

of the body. Pharynx very short and narrow; œsophagus strongly muscular, cylindrical, 1-47th in. long by 1-533rd in. broad; œsophageal bulb pyriform, 1-178th in. long, 1-222nd in. broad. Ventriculus dilated alaeform at commencement, cylindrical throughout. Rectum short, pyriform. Generative aperture forty-two annulations above the anal. Ovary double; ova 1-333rd in. long by 1-400th in. broad.

Length of body from 1-10th to 1-8th in.; breadth at middle 1-95th in. Tail 1-14th in. long by 1-111th in. broad at middle.

Hab. and Remarks.—*Streptostoma agile* and *Thelastoma attenuatum* are found together principally in the commencement of the large intestine of *Julus marginatus*, in numbers of from one to fifteen, and less frequently in the small intestine with *Ascaris infecta*, in numbers of from one to six. It is remarkable, that although I have found from one to fifteen of these two genera in nine-tenths of the animals examined, I have never yet been able to detect a single male.

Thelastoma always has the mouth projected, whilst *Streptostoma* has it retracted, producing, in some measure, but by no means wholly, the difference in size of the oral aperture.

At first I was inclined to think these two animals were different stages of the same species, but the adults uniformly correspond to the descriptions given, and in all cases contained more or less perfected ova.

Their movements are active, wriggling the body in a sigmoid manner and vibrating the delicate spiculated tail, which in sunlight resembles a shining acicular crystal.

Thelastoma, from its form of œsophagus and narrower annulations and shorter tail than *Streptostoma*, occupies a position between the latter and *Oxyuris*.

Gregarina, Dufour. Body consisting of two distinct cells. Inferior cell the larger, marked with delicate, parallel, longitudinal lines, (muscular?) and filled with a fine granular matter, obscuring one or two nucleolo-nucleated-organic cells. Superior cell placed in a depression of the inferior, surmounted by a slight papilla in which may be detected two lines, apparently outlines, of an oral canal to the interior of the cell which is filled with granular matter; cell-wall amorphous and transparent.

Gregarina larvata. Body opaque white, cylindrical or fusiform, frequently considerably dilated at the middle of the upper third. Superior cell a flattened or depressed sphere, received about one-half into a depression of the inferior cell, surmounted by a papillary elevation with traces of a communication with the exterior; interior filled with a finely granular mass resembling oil-globules, and measuring from 1-15,000th to 1-7500th in. Length of cell, in smallest individuals, 1-123rd in.; in largest 1-80th by 1-61st in. broad. Inferior cell elongated, cylindrical or fusiform, not communicating with the exterior nor with the interior of the superior cell; filled with a mass of granules resembling that of the superior cell, rendering the larger individuals opaque, but translucent in the smaller ones, and usually obscuring one or two comparatively large nucleolo-nucleated-organic cells, measuring from 1-888th to 1-308th in. in diameter. Cell-wall

marked with exceedingly regular, delicate, longitudinal, parallel lines about 1-9375th in. apart, apparently muscular in character.

Length from 1-160th to 1-30th in., by 1-830th to 1-111th in. in breadth.

Hab. Found in numbers of from half a dozen to over a hundred, in the ventriculus of *Julus marginatus*.

Gregarina is probably the larva condition of some more perfect animal, but in the 116 individuals of *Julus* which I have examined, I have not been able to detect any form which could be derivable from it. Creplin doubts its animality*. When I first discovered this body, thinking it to be a larva, I did not examine it carefully, and it was not until some time afterward, when, being desirous of ascertaining its true nature, upon examining some fresh specimens beneath the microscope, I detected movements of an animal character, and this led me to seek for muscular structure, which resulted in the discovery of the longitudinal lines of the inferior cell. These escaped the observation of Siebold, for he says, "Nach meine Beobachtungen bestehen die Gregarinen aus einer harten glatten den Eihüllen der Insekten-Eier ähnlichen Haut†." The movements of the animal are exceedingly sluggish, and consist of a very slow bending in any direction of any part of the inferior cell, most usually above the middle, rarely at the inferior extremity, but most frequently near the superior cell which is entirely passive. The superior cell is also frequently drawn or contracted within the inferior, and again protruded by the contraction of the latter, and the propulsion of the granular contents against it. The inferior cell is also frequently, more especially in younger individuals, intus-suscepted within itself through a partial contraction, and again relieved by a general contraction of the cell-wall.

In the state in which *Gregarina* is found, it would probably hold a rank between the *Trematoda* and *Trichina*, the lowest of the *Nematodea*.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 229.

On the mouthless Acari which have been formed into the genus Hypopus. By F. DUJARDIN.

Degeer, Hermann and Geoffroy found upon various insects some very small parasitical mites, to which they gave the name of *Acarus muscarum* and *Acarus spinitarsus*; they were not, however, able to study them on account of their extreme minuteness. Dugès, who examined a single one only, constituted the genus *Hypopus* of it, characterized by a sucker, provided with two rigid bristles, but regretting at the same time that he had not sufficiently studied it. Since that period, M. Léon Dufour has made known two other species, and M. Gervais has described a fifth species; but he has mistaken the projecting lines resulting from the contiguity of the hips for a nervous system. M. Koch in Germany has also described two other species of them, but without making any attempt at investigating their organization. M. Dujardin, who in 1842 described,

* Nachträge zu Gurlt's Verzeichniss der Thiere bei welchen Entozoen gefunden worden sind. Wiegmann's Archiv, 1846, 1 Band, S. 157.

† Wiegmann's Archiv, 1838, 2 Band, S. 308.

under the name of *Anoetus*, an *Acarus* found by Dr. Manceau de Chabre upon the wing of a bee, has been led to extend his researches to several allied species, and he has recognized that they ought to be united with *Hypopus*; i. e. that they, like his *Anoetus*, have neither a mouth nor a digestive apparatus; also that they are provided with suckers upon the posterior part of the abdomen, and that these suckers merely serve to fix them at their will, in readiness for their last metamorphosis, which is effected at the expense of the internal nutritive matter which they have received at their birth.

In 1847, M. Dujardin first found, upon *Musca stabulans* of Fallen, a *Hypopus* in the same state as the *Acarus muscarum* of Degeer, and it was in the case of this *Acarus*, which was $\frac{27}{100}$ ths of a millimetre in length, that he was enabled to determine the absence of the mouth and intestine. Since then, he has found other species upon *Staphylini* and *Cryptops*, but having the same organization; lastly, in September 1849, he found some upon a fern, *Ceterach officinarum*, among which there were a certain number of shells or teguments; these were perfect, but empty, transparent, narrower, and consequently more like those which he had seen upon the wing of the bee: the greater number were living, and continued to live in water; and the power with which these *Acari* are able to fix themselves to a plate of glass was then noticed. Some of them, which were few in number, and had become immoveable, exhibited through their integument another form of *Acarus* which filled the whole of its internal cavity, and which were furnished with a mouth, having at the same time palpi and chelicera like the *Gamasi* and the *Dermanysssi* which live in great numbers in the same situation. From that time it became evident that the *Hypopi*, which had no mouth, nor any possible mode of growth, and which lived fixed upon polished surfaces that could yield them nothing—it was evident, shall we say, that these *Hypopi* are the larvæ, or rather, if we may use the expression, the ova furnished with feet, in the interior of which, without any food derived from without, the young *Gamasus* is formed, solely at the expense of the contained substance.

Consequently, M. Dujardin has been enabled to search for and find other *Hypopi* upon all the insects infested by the *Gamasi*, such as the *Geotrupidæ*, the *Necrophoridæ*, the Humble-bees, &c. They are most commonly found at the base of the abdomen, or beneath the first rings, or in the anfractuositics of the metathorax; but judging from the diversity of their forms, we should think that there would be different species of *Gamasi*, or *Dermanysssi*, or even *Uropodi*. Other species have been found by beating the branches of trees; and lastly, one species, which is very remarkable by its method of fixation, has been found upon subterranean rodents (*Arvicola subterranea*), upon which also the *Gamasi* are parasitic. The latter *Hypopus*, in fact, would not have been able to fix itself upon the hairs or upon the skin by the suckers; hence it is furnished, beneath the upper part, with a pair of striated lobes or tubercles, which becoming approximated like two lips, firmly embrace the single hairs of the mammifer.

In short, the *Hypopi* are *Acari* with eight feet, without either mouth or intestine, and which, being deprived of all means of alimen-

tation, fix themselves at will so as to undergo a final metamorphosis, and they become *Gamasi* or *Uropodi*, from which they differ as much at least as the swimming *Hydrachni* or *Aeari* differ from their larvæ; but these fix themselves by their mouth, and increase by sucking the nutritive fluid of the insects of which they are the parasites. Ought therefore the *Hypopi* to be called larvæ, when under this denomination have hitherto been comprised animals capable of nourishing themselves by aliment derived from without, thus accumulating the materials requisite for their ulterior transformations, so that in those insects the metamorphosis of which is complete, the pupa takes no further nutriment, and the perfect insect is sometimes in the same case, as in *Bombyx* for example? Here, on the contrary, we have a *Hypopus* provided with limbs like an active larva, but taking no nutriment: the *Gamasi* alone in their perfect state can feed and grow. — *Comptes Rendus*, Feb. 5, 1850.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1850.

Chiswick.—February 1. Densely clouded: showery. 2. Slight rain. 3. Cloudy: clear. 4. Very fine. 5. Slight rain: very fine: showery. 6. Boisterous. 7. Fine. 8. Hazy. 9. Very boisterous. 10. Clear: very fine. 11. Rain: boisterous. 12. Overcast: boisterous. 13. Clear and dry: frosty at night. 14. Rain: drizzly. 15. Cloudy: rain. 16. Clear. 17. Overcast. 18. Cloudy: very fine. 19. Overcast. 20. Densely overcast: rain. 21. Overcast: clear at night. 22. Cloudy: very fine. 23. Overcast and fine. 24. Overcast. 25. Foggy. 26. Foggy: overcast: clear. 27. Foggy: very fine: clear. 28. Foggy.
Mean temperature of the month 42°·80
Mean temperature of Feb. 1849 41°·35
Mean temperature of Feb. for the last twenty-three years. 39°·56
Average amount of rain in Feb. 1·61 inch.

Boston.—Feb. 1. Cloudy. 2—4. Fine. 5. Cloudy: stormy P.M.: distant lightning. 6. Cloudy: stormy A.M. 7. Fine. 8. Cloudy. 9. Fine: rain P.M. 10. Fine. 11. Cloudy: rain A.M. and P.M. 12. Cloudy: rain and snow P.M. 13. Fine: rain P.M. 14. Cloudy: rain A.M. 15. Fine. 16. Fine: rain A.M. 17. Fine. 18. Cloudy. 19. Fine. 20, 21. Cloudy. 22. Fine. 23—28. Cloudy.

Applegarth Manse, Dumfries-shire.—Feb. 1. Heavy rain nearly all day. 2. Rain all day: storm P.M. 3. Rain, with high wind. 4. Dull and cloudy. 5. Dull A.M.: severe storm of wind and rain. 6. Hurricane, with heavy rain. 7. Snow $\frac{2}{10}$ ths of an inch deep: rain P.M. 8. Frost early: rain and wind P.M. 9. Rain and high wind all day. 10. Fine: frost A.M.: showery P.M. 11. Snow: rain: wind. 12. Rather fine: slight shower. 13. Hard frost: clear and fine. 14. Rain thick and close. 15. Rain: stormy P.M.: very wet. 16. Showers: very changeable. 17, 18. Wet A.M.: dull and moist all day. 19. Rain, and fog and wind. 20. Showers, short but severe. 21. Rain: storm of wind. 22. Fair, but unsettled-looking. 23. Fair: cloudy. 24. Fair and fine. 25. Rain during the night: moist. 26. Fine A.M.: showery P.M. 27, 28. Dull, but fair and mild.

Mean temperature of the month 41°·7
Mean temperature of Feb. 1849 41°·2
Mean temperature of Feb. for the last twenty-eight years. 37°·6
Average amount of rain in Feb. for the last twenty years. 2·04 inches.

Sandwick Manse, Orkney.—Feb. 1. Cloudy: rain: cloudy. 2. Showers: thunder: cloudy. 3. Showers. 4. Sleet: cloudy. 5. Cloudy: sleet-showers. 6. Showers: clear: aurora. 7. Showers: clear. 8. Cloudy: frost: sleet-showers. 9. Snow-showers. 10. Bright: snow-showers. 11. Cloudy: clear. 12. Bright: snow-showers: aurora. 13. Snow-showers: cloudy: aurora. 14. Rain: drizzle. 15. Cloudy: hazy: aurora. 16. Sleet-showers: hazy. 17. Rain: drizzle. 18. Hazy: drizzle. 19. Rain: hazy: cloudy. 20, 21. Sleet-showers: showers. 22. Cloudy: showers. 23. Cloudy: hazy. 24. Drizzle: fine. 25. Cloudy: fine. 26. Clear: fine. 27. Drizzle: cloudy. 28. Cloudy: fine.

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[SECOND SERIES.]

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XXIX.—*On the Nostochineæ.* By JOHN RALFS, M.R.C.S.,
Penzance*.

[With two Plates.]

FROND gelatinous, containing simple, jointed, generally moniliform filaments. Some joints enlarged, all finally separating.

The *Nostochineæ* may be regarded as a tribe of freshwater and terrestrial Algæ, for only a very few of its species are either littoral or inhabitants of brackish waters. They are allied on the one hand to the *Oscillatoria* and on the other to the *Palmelleæ*; but I consider they have a closer affinity to the former than to the latter. Some species of *Nostoc*, to the naked eye, have considerable resemblance to fronds of *Rivularia*. Without the use of the microscope we are sometimes unable to distinguish *Trichormus* and *Sphærozyga* from *Oscillatoria*, and even with its assistance the young filament in *Spermosira* is liable to be regarded as an *Oscillatoria*. So closely too is this family allied to the *Palmelleæ*, that some distinguished naturalists have united them. *Hormospora* in the latter scarcely differs from it except by its uniform and more distant cells.

In the *Nostochineæ* the filaments are always imbedded in gelatine. In *Nostoc* and *Hormosiphon* this gelatine is very evident, and, especially in the young plant, is comparatively firm. It is, indeed, often fleshy or even cartilaginous, and externally is always condensed so as to form a distinct covering or epidermis (generally smooth and glossy) which limits the frond and gives it a definite form. In *Trichormus* and the remaining genera the plant forms a stratum of no determinate form or extent.

In all the genera the filaments are simple, jointed and usually moniliform, and finally break up into single joints. Their joints

* Read before the Botanical Society of Edinburgh, April, May, June and July 1849.

or cells are commonly more or less orbicular, but sometimes disciform or cylindrical, and in a few instances confluent. At first they are uniform; they divide in the same way as they do in other simple Algæ, and during division are geminate.

I believe that the filaments multiply in consequence of the division of the joints being here and there complete in the same way as in *Oscillatoria*; because we find that the filaments in an early state (as Mr. Hassall has correctly noticed) are but sparingly scattered through the mass, whereas in mature specimens they become very numerous. Mr. Hassall considers that this increase results from the separation or dislocation of the enlarged cells. I believe, on the contrary, that when the enlarged cells are fully formed the plant approaches maturity, and the filaments cease to multiply. The following facts will, I think, prove that the multiplication of the cells has no essential connection with the enlarged joints. In *Cylindrospermum* they terminate the filament, yet here the filaments are as numerous as in the other genera, nor do we find them of more unequal lengths, which would however necessarily be the case if the enlarged terminal joints separated to form new filaments; and further, the enlarged joints themselves are not developed until after the filaments have become numerous.

As I have stated above, the joints or cells are at first uniform in size and figure; but in the mature plant they are of three different kinds, all of which are generally, though not I believe invariably, present in the same filament. These are—

1st. *Ordinary joints or cells*.—Of these I shall only observe, that they divide by separating into two hemispheres, each gradually acquiring a new portion in the room of that from which it has separated, and that until this process is complete they appear geminate. As this geminate state is common to every species during growth, it cannot be employed as a specific character, and as the other cells do not divide, the elongation of the filament must be solely due to the ordinary ones. Their endochromes are slightly granular, which gives them a dotted appearance.

2nd. *Vesicular joints or cells**.—These make their appearance at an early period. They are generally orbicular, but sometimes elliptic, and are usually larger than the ordinary cells. They are evidently analogous to the vesicles present in *Rivularia* and in some of the *Oscillatorieæ*. They do not contain granular matter, but are filled with a bluish fluid, which eventually acquires a brown tint. When mature they are frequently furnished with diverging hairs or cilia. They seem to be connected with the adjacent

* By Mr. Thwaites they are named, from their usual position, "connecting cells;" they have also been called "Heterocysts."

cells by a minute orifice at each end, which *in situ* looks like a minute globule; by this peculiar appearance and by the absence of granular matter the vesicular cells may be easily recognized.

3rd. *Enlarged cells or sporangia*.—These are produced by enlargement of the ordinary cells, and are the last formed. They are filled with a dense granular matter which becomes homogeneous and opaque, and finally turns from green to brown like the sporangia in the *Conjugatæ* and *Desmidiæ*. When they are fully developed the filament has fulfilled its function, separates into single joints and disappears. The sporangia in *Nostoc* and *Trichormus* differ but little except in size from the ordinary joints, and are more or less orbicular. In *Sphærozyga* and *Cylindrospermum* they are either elliptic, oblong or cylindrical. Usually they are, even before the appearance of granular matter, easily distinguished from the vesicular cells by the absence of the remarkable puncta-like globules I have just noticed. The sporangia continue to enlarge after their separation from the filament.

That these enlarged cells are true sporangia I cannot doubt; but the nature of the vesicular cells is less certain. The coexistence of the vesicular cells and sporangia in the same filament may lead to a better understanding of their office in other tribes. As the former are evidently of the same nature as those present in *Rivularia* and in some of the *Oscillatorieæ*, we cannot pronounce that they are reproductive organs in the one family and not in the other.

On the present occasion I shall examine only those genera of the *Nostochineæ* in which the plant forms a stratum. As I have before remarked, they form more or less extended patches, either on the damp soil or on aquatic plants, or at the bottom of pools and ditches. Their colour is bluish green or verdigris, and the stratum is extended by the filaments radiating at its margin. Hence both in colour and habit, as well as in general appearance, they resemble species of *Oscillatoria*; the stratum, however, is usually more tender and gelatinous. The mass, which in an early state is somewhat translucent, at length commonly becomes opaque and presents a pulverulent appearance.

The facility with which the filaments break up, especially in warm weather, considerably increases the difficulty of studying these plants. When the plant is mature, the destruction of the filament so frequently takes place in a few hours, even though it be kept in water, that recent specimens forwarded to any distance seldom arrive in a condition fit for examination; I am therefore less able to profit by the examination of those sent me from other districts. Even when they are mounted in fluid, the labour is

often rendered useless by the separation of the filament into single cells. The destruction of the filament is attended by the escape of the colouring matter, which stains the water or whatever is in contact with the mass, and is usually the first sign of that destruction.

I find the best method of preserving specimens is to dry them as quickly as possible on talc or glass. Specimens preserved on paper can rarely be removed without injury. In examining specimens that have been dried, it is necessary to bear in mind, that although, when revived by adding a little water, they present characters apparently but little altered from their recent ones, yet their joints are then more distinct and orbicular from contraction at their junction; hence a cell quadrate in the recent plant will be orbicular in the revived one. I have elsewhere mentioned that from a similar cause the dried frond in *Closterium* appears more attenuated at the extremities than is natural, and I fear that from inattention to this fact descriptions taken from dried specimens are sometimes faulty.

Until the publication of Professor Kützing's 'Phycologia Generalis,' the described species belonging to this group were few in number, and usually retained in a single genus either as *Anabaina*, Bory, or *Sphærozyga*, Ag. Professor Kützing has now determined upwards of thirty species, which he has distributed in four genera*.

Attempts to ascertain the earlier synonyms in tribes which require the aid of the microscope to detect the generic and specific differences are necessarily attended with much difficulty. Not only are our present instruments far superior to those used a few years ago, but when natural history began to take its proper rank in science, the higher tribes sufficiently taxed the time and skill of collectors and writers; it is therefore not surprising that the more minute Cryptogamia should have been comparatively neglected. The descriptions were chiefly taken from characters obvious to the naked eye, and besides were often so brief and at the same time so vague, that they were equally applicable to members of very different genera; hence authors, unable to determine with certainty the species of their predecessors, were frequently compelled either to depend on chance in

* I take this opportunity of directing attention to his 'Tabulæ Phycologicae,' now publishing in numbers in a cheap form, and containing magnified figures of every species known to him. To those who wish to identify our British freshwater Algæ it is indispensable. Of British species of *Oscillatoria* we have no figures of the slightest value, for unfortunately Mr. Hassall, many of whose figures in other genera are very useful, has, in every figure which he has given of that genus, omitted to give the ends of the filaments, though they are often essential to the determination of the species.

the employment of old names, or, renouncing the task as hopeless, to invent new ones. In the present group all these difficulties have been experienced, and unless authentic specimens, in a fit state for examination, exist in the collections of Linnæus and other early botanists, it must in some instances be impossible to affix their names with any certainty. I cannot flatter myself that my nomenclature will be free from error; but I venture to hope that by pointing out the essential peculiarities of these plants, and by more detailed descriptions of the species, I shall facilitate the labour of those who can find opportunity for inspecting the herbaria of original authorities.

Should I succeed in my endeavours to elucidate the British species, the success will be due in a great measure to the kind assistance of my fellow-students. Mr. Thwaites, who in Harvey's 'Phycologia Britannica' was the first to recognize three kinds of cells, has supplied descriptions of some species which I have not met with. Other friends, especially Professor Allman, Mr. Andrews, Mr. Jenner, Mr. Moore, the Rev. T. Salwey, and Mr. W. Thompson, have aided me by specimens accompanied with remarks; whilst Mr. Borrer has enabled me, by means of his rich botanical library, to clear up points on which I must otherwise have remained in doubt*.

* The following synoptical table will, it is hoped, convey a clear idea of the characters distinguishing respectively the various genera proposed to be described. The genus *Nostoc* is not included in the present paper on account of the necessity which exists of a further examination and study of its several species, some of which have been stated by Professor Kützing and M. Fries to be merely a condition of species of *Collema*.

Synoptical Table of Genera.

I. Filaments not included in a membranous sheath.

a. Frond definite.

1. *Monormia*, Berkeley.

b. Frond indefinite.

2. *Trichormus*, Allman. *Vesicular cells* interstitial and terminal. *Sporangia* formed first from the cells at the greatest distance from the vesicular cells.
3. *Sphærozyga*, Ag. *Vesicular cells* interstitial. *Sporangia* formed first from the cells nearest the vesicular cells.
4. *Cylindrospermum*, Kützing. *Vesicular cells* terminal. *Sporangia* as in *Sphærozyga*.
5. *Dolichospermum*, n. gen. *Vesicular cells* interstitial. *Sporangia* without any definite arrangement, and of unequal length.

II. Filaments included in a membranous sheath.

6. *Aphanizomenon*, Morren. *Vesicular cells* none? *Sporangia* usually single and of unequal length.
7. *Spermosira*, Kütz. *Vesicular cells* interstitial, single or sometimes two together. *Sporangia* as in *Trichormus*.

MONORMIA*, *Berkeley*.

Frond definite, gelatinous, elongated, linear, spirally curled and convoluted, inclosing a single continuous moniliform filament.

Monormia is very closely allied to *Trichormus*, Allman, differing principally, if not solely, in its definite linear frond, which incloses a single moniliform filament to be traced throughout all the peculiar convolutions of the frond. The *vesicular cells* are interstitial and occur singly. The *sporangia* are numerous, and are first formed from the cells at the greatest distance from the vesicular cells.

Without due attention *Monormia* might easily be mistaken for a species of *Nostoc*, but the mass formed by its convoluted frond is not inclosed by a common membranous pellicle as in that genus.

Monormia intricata, Berk. Gleanings of British Algæ, p. 46. t. 18 (1832); Harvey, Man. of Brit. Algæ, p. 185; Phycologia Britannica, t. 256; Hassall, Brit. Fresh. Algæ, p. 286. t. 75. fig. 11. *Nostoc intricatum*, Meneghini, Mon. Nostoch. Ital. p. 122 (1842). *Anabaena intricata*, Kützing, Phycologia Germanica, p. 171 (1845); Species Algarum, p. 288; Tabulæ Phycologicæ, p. 50. t. 94. fig. 1.

In ditches of the marsh to the south of Frindsbury Canal, near Gravesend, *Rev. M. J. Berkeley*; in brackish ditches at Shirehampton, near Bristol, *G. H. K. T.*; near Wareham, *Rev. W. Smith*. Germany, *Kützing*.

This species occurs in slightly brackish ditches as floating gelatinous masses, each about as large as a walnut, and usually of a reddish brown colour. When a small portion of the plant is examined with a lens of moderate power, it is seen to consist of an elongated continuous moniliform filament included in a definite linear gelatinous sheath, which is very much curled and convoluted, and the apposed surfaces of which are more or less coherent. The vesicular cells are somewhat oblong, and rather larger than the nearly spherical ordinary cells. The sporangia are numerous, twice the diameter of the ordinary cells, and perfectly spherical.

When the sporangia are mature the definite outline of the linear frond is almost lost, and then there is little to distinguish the plant from *Trichormus* but the peculiar convolutions of the moniliform filament. The original colour of the gelatinous frond has also then disappeared, and the plant has assumed a pale greenish tint.

In drying, the plant stains paper of a deep blue or purplish colour.

PLATE VIII. fig. 1.

* By Mr. G. H. K. Thwaites.

TRICHORMUS, *Allman*.

Filaments simple, moniliform, distinctly jointed, aggregated into an indeterminate gelatinous stratum; sporangia separated from the vesicular cells by the ordinary joints, which they more or less resemble in form.

(*Anabaina*, Bory, Brébisson, Kützing, Montagne and others.)

In *Trichormus* the stratum is indeterminate and very gelatinous; at first it is nearly colourless and transparent, and the filaments are only sparingly scattered through the matrix; but the filaments rapidly increase in number, and the mass, gradually becoming more opaque, acquires at length a deep bluish green colour, which is occasionally mottled with brown, especially beneath.

The filaments are mostly short, distinctly moniliform, and frequently as much curved as those of a *Nostoc*. The cells are all more or less orbicular, and the sporangia differ less from the ordinary cells than they do in the following genera. Viewed under the microscope the filaments scarcely differ from those of a *Nostoc*. In both genera they are usually curled, their cells are orbicular, the vesicular ones are interstitial and terminal, and the sporangia are often not apparent, or are known only by their denser endochromes.

In some of the aquatic species the stratum separates into large floating gelatinous masses, and then can only be distinguished from *Nostoc* by the gelatinous portions having no definite form or size, and by the absence of an epidermis.

Professor Kützing refers *Monormia intricata*, Berk., to this genus. I have never gathered that plant, and I was unable to determine the genus from recent specimens sent me by Mr. Thwaites from Bristol; but, judging from Mr. Berkeley's figures and description, I should suppose that the more definite frond and the elongated, solitary and peculiarly convoluted filament are sufficient to sustain the genus.

As Professor Harvey has reminded us in his 'Phycologia Britannica' that Bory's name *Anabaina* has been appropriated to a genus of flowering plants, and it becomes necessary to choose another, I have adopted Professor Allman's name *Trichormus* as next in priority.

Trichormus differs from *Dolichospermum* in its sporangia, which are more or less orbicular, and from *Sphærozgya* and *Cylindrospermum* by the different arrangement of the sporangia and vesicular cells.

1. *T. Flos-aquæ* (Lyngbye). Filaments flexuose or curved, moniliform; cells orbicular, vesicular ones larger, terminal and interstitial. *Nostoc Flos-aquæ*, Lyngbye, Tentamen Hydrophytologiæ Danicæ,

p. 201. t. 68. fig. D (1819). *Anabaina membranina*, Bory, Arthr. fig. 7 *d* (according to Kützing); Mougeot et Nestler, Stirpes Cryptogamiæ Vogeso-Rhenanæ, no. 896. *Anabæna Flos-aquæ*, Trevir. in Linn. 1843, t. 3. fig. 5-7; Kützing, Phycologia Generalis, p. 209; Phycologia Germanica, p. 171; Species Algarum, p. 289. *Sphærozyga membranina*, Endlicher, Mantissa Bot. Alterum Sup. tertium, p. 12 (1843). *Trichormus incurvus*, Allman, Annals of Nat. Hist. vol. xi. p. 163. t. 5 (1843); Hassall, Brit. Freshwater Algæ, p. 285. t. 75. fig. 1.

Stagnant pools and other still waters. Portmore Lough, Antrim, Mr. W. Thompson; Ayrshire, Rev. D. Landsborough; Dolgelley, J. R.; Oswestry, Shropshire, Rev. T. Salwey; Grand Canal Dock, Dublin, Professor Allman.

Finland, *Lyngbye*; France, *Bory*; Germany, *Kützing*.

Trichormus Flos-aquæ rises to the surface of the water in gelatinous masses of considerable size, and is generally of a rich bluish green colour. Filaments curved and beautifully moniliform. Cells spherical; vesicular ones resembling the ordinary ones, but larger and without granular matter. Sporangia I have not detected, but since cells, not different in form from ordinary ones, are often filled with granular matter, there is probably no very obvious difference between the latter and the sporangia.

PLATE VIII. fig. 2.

2. *T. spiralis* (Thompson). Filaments coiled or spiral; ordinary cells subquadrate or orbicular; vesicular cells and sporangia orbicular. *Anabaina spiralis*, Thompson in Annals and Mag. of Nat. Hist. vol. v. p. 81 (1846). *Spirillum Thompsoni*, Hassall, Brit. Freshwater Algæ, p. 278. t. 75. fig. 7 (1845).

Ballydrain Lake, near Belfast, Mr. Thompson; Petersfield, Mr. Jenner.

I regret that the specimens Mr. Thompson has sent me are too imperfect to serve for the identification of the species. I am by no means certain that Mr. Jenner's plant is identical with the Irish one, and I have referred it to this species in deference to the opinions of Mr. Thwaites and Mr. Jenner, rather than from my own conviction.

The filament in Mr. Jenner's specimen is somewhat coarse, and coiled rather than loosely spiral. The ordinary joints are more or less quadrate, the vesicular cells orbicular, and the sporangia similar to the ordinary cells, but larger and more orbicular. Mr. Thompson's figure represents his *T. spiralis* with perfectly orbicular ordinary cells, and a slender filament which, except in being spiral, scarcely differs from *Trichormus Flos-aquæ*.

PLATE VIII. fig. 3. *a*, Mr. Jenner's specimen; *b*, fragment of Irish specimen with sporangium between ordinary cells; *c*, mature sporangium.

3. *T. Thwaitesii* (Harv.). Filaments moniliform, slightly flexuose; ordinary cells globular or nearly so; vesicular cells larger, globular when interstitial, ovate when terminal, ciliated; sporangia oval, catenate. *Sphærozyga Thwaitesii*, Harvey, Phycologia Britannica, t. 113 B (1847).

Salt-marshes, Dolgelley, North Wales, and Hayle, near Penzance, J. R.; Shirehampton, near Bristol, Mr. Thwaites; Portbury, Somersetshire, Mr. Broome; near Hastings, Mr. Jenner.

Trichormus Thwaitesii forms thin, gelatinous, dark green patches either on the damp soil covered at spring-tides or at the bottom of brackish ditches or pools. Filaments moniliform, elongated, pale bluish green. Ordinary joints nearly orbicular, except when dividing. Vesicular cells interstitial and terminal, ciliated, twice as large as the ordinary ones, ovate when terminal, otherwise spherical. Sporangia oval or nearly globular, larger than the ordinary cells, beginning near the centre of the filament and forming chain-like groups of six or more together.

Mr. Thwaites's specimens vary in some respects from those I have gathered. I find the stratum very thin and tender, and the sporangia rarely produced; but Mr. Thwaites informs me, that at Bristol, on the contrary, it forms, after a time, large, floating, gelatinous masses, and then abounds with sporangia.

Trichormus Thwaitesii is more likely to be confounded with immature specimens of *Sphærozyga Carmichaelii* than with either of the preceding species of this genus, especially as they often grow intermixed. In the present plant however the filament is longer, the ordinary cells are more globular, and the terminal cell either resembles the others or is ovate and vesicular. Its ciliated and globular vesicular cells distinguish it from *T. oscillarioides* and *T. recta*.

A specimen of *Anabaina variabilis* sent me by Professor Kützinger is apparently identical with the present species; but, as the former is described as lacustrine, with attenuated ends, I have thought it advisable not to unite them*.

PLATE VIII. fig. 4. *a*, immature filament; *b*, mature filament.

4. *T. oscillarioides* (Bory). Filaments elongated, flexuose; ordinary joints subquadrate, distinct; vesicular cells barrel-shaped or elliptic, naked; sporangia oval, catenate. *Anabæna oscillarioides*, Bory, Dict. Class. d'Hist. Nat. *Sphærozyga oscillarioides*, Kütz. Species Algarum, p. 291 (1849); Tabulæ Phycologicæ, t. 96. fig. 5. *Trichormus affinis*, Ralfs in lit.

Brackish ditches. Shirehampton, near Bristol, Mr. Thwaites.

* "*Anabaina variabilis*, lacustris, mollis, viridi-æruginea; trichomatibus attenuatis, ærugineo-viridibus, laxè implicatis; articulis ellipticis, majoribus, granulosis."—Kützinger, Phyc. Gener. p. 210.

Stratum bluish green; filaments elongated, flexuose, moniliform, often attenuated at the ends. Ordinary joints quadrate, with rounded angles, frequently longer than broad, terminal ones conical. Vesicular cells oblong, usually flattened at the ends so as to appear barrel-shaped, broader than the ordinary joints, and, according to Mr. Thwaites, always naked. Sporangia elliptic, catenate, and somewhat larger than the ordinary cells.

Trichormus oscillarioides differs from *T. Thwaitesii* by its more quadrate ordinary cells and by its smooth and elliptic vesicular cells. It may be known from *T. recta* by its elongated filaments and by its more quadrate ordinary cells.

PLATE VIII. fig. 5.

5. *T. rectus** (Thw. MS.). Filaments bright green, straight, short, slightly tapering towards the extremities; ordinary cells subspherical, rather shorter than wide; vesicular cells oblong, smooth, scarcely wider than the ordinary cells, and never terminating the filament; sporangia spherical or oblong, numerous.

Pools. Hanham, near Bristol, August 1847, *G. H. K. Thwaites*.

This little species differs from every other we have seen in its short, straight filaments, which are of a beautiful green colour. The vesicular cells, of which there are seldom more than one or two in each filament, are of a reddish colour, and about half as long again as wide. The ordinary cells are nearly spherical, somewhat compressed, so as to be rather wider than long. The sporangia vary in shape from spherical to oblong.

PLATE VIII. fig. 6.

SPHÆROZYGA, *Ag.*

Filaments simple, generally moniliform, aggregated into a gelatinous stratum; sporangia interstitial, in groups of two or more connected by a vesicular cell.

(*Sphærozyga*, Agardh, Endlicher, Kützing, Montagne. *Anabaina*, Bory, Brébisson.)

Sphærozyga agrees with *Trichormus*, *Dolichospermum*, *Cylindrospermum*, *Aphanizomenon* and *Spermosira* in its mode of growth as well as in the colour and general appearance of its stratum, and differs from those genera solely in the microscopic characters of its filaments.

The filaments are somewhat elongated. The joints, though seldom so orbicular as in *Trichormus*, are usually very distinct. The sporangia are generally elongated and cylindrical; they occur in little groups of two or four, with a vesicular cell interposed at the centre. Sometimes a vesicular cell has a sporangium

* For the description of this species I am indebted to Mr. Thwaites.

on one side and apparently an ordinary cell on the other, but this occurs only when the sporangia begin to be developed, and the individual on one side is more forward than that on the other. In such a case close examination will detect a slight preliminary elongation of the incipient sporangium. The sporangia indeed are always developed, first on one side of the vesicular cell and then on the other, and whatever number may occur together they follow the same rule, and are produced alternately adjacent to those previously formed, and as they are thus produced in succession they all vary in size (except in the mature plant), the inner ones in each group being the largest.

Sphærozyga differs from *Trichormus* and *Dolichospermum* by producing its sporangia adjacent to the vesicular cells; its filaments also are straighter, and its sporangia more elongated than in the former genus. The interstitial position of the sporangia and vesicular cells distinguishes it from *Cylindrospermum*, and the ordinary cells are not disciform as in *Spermosira*.

* *Filaments moniliform; sporangia elongated, not turgid.*

1. *S. Carmichaelii* (Harvey). Filaments moniliform, with tapering extremities; ordinary joints distinct, subquadrate; sporangia oblong; vesicular cells spherical. *Belonia torulosa*, Carmichael, Alg. Appin ined.; Harvey in Hooker's Brit. Flora, vol. ii. p. 379 (1833); Manual of Brit. Algæ, p. 167. *Sphærozyga compacta*, Kützing, Phycologia Generalis, p. 211 (1843); Phycologia Germanica, p. 172. *Anabæna marina*, De Brébisson in Ann. Sc. Nat. !; Kützing, Species Algarum, p. 287; Tabulæ Phycologicæ, t. 92. fig. 111. *Sphærozyga Carmichaelii*, Harvey, Phycologia Britannica, t. 113 A (1847); Kützing, Species Algarum, p. 294; Tabulæ Phycol. t. 99. fig. 4.

β. *tenuissima* (—). Filaments very slender.

On the damp soil in salt-marshes flooded at spring tides, more rarely in brackish ditches or upon decaying marine algæ. Appin, Capt. Carmichael. Anglesea; Barmouth; Peuman Pool near Dorgelley; Braunton near Barnstaple; Penzance, J. R. Shirehampton near Bristol, Mr. Thwaites.

β. Shirehampton, Mr. Thwaites.

France, Brébisson; Germany, Kützing.

Stratum tender, very thin, of a dark or bluish green colour when recent, but opaque and glaucous when dry. Filaments short, straight, slender, moniliform, with attenuated ends. Ordinary joints distinct, the terminal ones longer than broad and triangular or conical, the others nearly equal in length and breadth, at first quadrate, finally rounded at their angles, and when dried orbicular. Whilst dividing they are geminate and longer than broad. Vesicular cells orbicular or oval and generally ciliated.

Sporangia oblong, three times longer than broad, much broader than the ordinary cells, one or two on each side of the vesicular cell, the outer ones generally smallest.

The best distinctive mark of this species is the subacute extremities, combined with the short filament and littoral habitat. There are rarely more than one or two groups of enlarged cells; when only one is present it is situated near the centre of the filament. I believe that the attenuated extremities are constant, at least in the young plant, unless the filament has been broken.

The var. β . differs in having much slenderer filaments: I am not sufficiently acquainted with it to determine whether it be, as Mr. Thwaites supposes, a distinct species.

PLATE VIII. fig. 7. *a*, *b*, ordinary form; *c*, var. β .

2. *S. Jacobi* (Ag.). Filaments elongated, their ends usually attenuated; ordinary cells subspherical; vesicular cells spherical; sporangia oblong or cylindrical. *Sphærozyga Jacobi*, Agardh, Icones Algarum Europæarum!; Berkeley in Eng. Bot. t. 2826. fig. 2.

Upper Mill, Dolgelley; near Swansea, *J. R.* Durham Down near Bristol, *Mr. Thwaites*!

Carlsbad, *Agardh*! Madeira, *Rev. T. Salwey*.

Sphærozyga Jacobi occurs in thick bluish green gelatinous masses, from which the filaments issue in long rays. The filaments are moniliform, elongated, and generally taper at their ends. Ordinary joints at first somewhat quadrate but finally orbicular, the terminal one longer than broad and usually conical. Vesicular cells spherical, larger than the ordinary joints, but not so broad as the sporangia. Sporangia oblong or cylindrical, one or two on each side of the vesicular cell.

Agardh's figure represents his *Sphærozyga Jacobi* as having the ordinary joints closely united, in fact separated merely by transverse dissepiments, and consequently so unlike the present plant, that I should scarcely have suspected their identity if Mr. Borrer had not afforded me an opportunity of examining an authentic Carlsbad specimen which he received from Agardh himself.

Sphærozyga Jacobi in some respects agrees with *S. Carmichaelii*; but the filaments are stouter and more elongated, the ordinary cells are more orbicular, its habitat is also different, and the dried plant wants the opake verdigris appearance so usual in the latter. The orbicular ordinary and vesicular cells distinguish it from *S. elastica* and *S. leptosperma*.

PLATE VIII. fig. 8. *a*, immature filament; *b*, mature state.

3. *S. elastica* (Ag.). Filaments moniliform, dissepiments conspicuous; ordinary cells quadrate; vesicular ones elliptic; sporangia

cylindrical, truncate. *Sphærozyga elastica*, Agardh, Icones Algarum Europæarum. *Cylindrospermum elongatum*, Kützing, Species Algarum, p. 294 (1849); Tabulæ Phycologicæ, t. 99. fig. 111.

Cromlyn Bog near Swansea, *J. R.*

Sweden, *Agardh*; Germany, *Braun*.

Stratum deep bluish green, tender. Filaments elongated, constricted at the dissepiments. Ordinary cells about equal in length and breadth; but when dividing they lengthen, and though quadrate in the recent plant they acquire slightly rounded angles when dry. Vesicular cells at first barrel-shaped, finally elliptic. Sporangia cylindrical, four to eight times longer than broad, their ends at first truncate, but rounded after separation.

The moniliform filaments and shorter joints distinguish this species from *Sphærozyga leptosperma*, and its elliptic vesicular cells from *S. Jacobi* and *S. Carmichaelii*.

PLATE VIII. fig. 9. *a*, immature filament; *b*, mature state.

** *Filaments moniliform; sporangia turgid, much broader than the ordinary cells.*

4. *S. Broomeii* (Thwaites). Filaments moniliform, elongated; ordinary joints suborbicular; vesicular cells barrel-shaped or elliptic; sporangia elliptic, catenate. *Sphærozyga Broomeii*, Thwaites.

Brackish ditch at Shirehampton, near Bristol, *Mr. Broome*.

Stratum bluish or yellowish green. Filaments elongated, obtuse; ordinary cells at first nearly quadrate, but finally orbicular. Vesicular cells smooth, at first barrel-shaped, then elliptic, broader than the ordinary joints, but not so broad as the sporangia, which are elliptic and numerous.

The gelatinous matrix is firmer than in many species of this genus, and under the lens can be detected without difficulty.

The numerous sporangia in each series distinguish *Sphærozyga Broomeii* from every other species I am acquainted with.

PLATE VIII. fig. 10. *a*, immature filament; *b*, mature state.

5. *S. Berkeleyana* (Thwaites). Ordinary joints spherical or slightly compressed; vesicular cells spheroidal, compressed, as broad as the large turgid-elliptic sporangia. *Sphærozyga Berkeleyana*, Thwaites.

Brackish ditch at Shirehampton, near Bristol, *Mr. Thwaites*.

Filaments elongated; ordinary joints nearly globular, sometimes compressed and slightly broader than long, terminal ones longer and somewhat tapering. The vesicular cells are globular in dried specimens (but Mr. Thwaites informs me that in the recent state they are compressed); they are nearly as broad as the sporangia, which are large, broadly elliptic, and sometimes almost globular.

The turgid sporangia and large, compressed vesicular cells characterise the species.

PLATE VIII. fig. 11. *a*, immature state; *b*, mature state.

6. *S. Mooreana* (—). Ordinary joints subspherical; vesicular cells barrel-shaped, much narrower than the large broadly-elliptic sporangia.

Ireland, *Mr. Moore*, to whom I am indebted for specimens.

Ordinary cells minute, somewhat orbicular. Sporangia very turgid, often nearly orbicular, much larger than either the vesicular or the ordinary cells. Vesicular cells minute, smooth and barrel-shaped.

I regret that I have only seen imperfect and dried filaments of this species intermixed with *Nostoc variegatum*, Moore; in a recent state therefore the form of the ordinary cells may not agree with the above description, still the large turgid sporangia must distinguish it from every species but *Sphærozyga Berkeleyana*, and from that it differs in its vesicular cells, which are comparatively much smaller and also longer than broad.

PLATE VIII. fig. 12. Mature filament.

*** *Dissepiments obscure, cells longer than broad.*

7. *S. leptosperma* (Kützinger). Filaments elongated, not constricted at the dissepiments; ordinary joints longer than broad, confluent; vesicular cells elliptic; sporangia linear. *Cylindrospermum leptospermum*, Kützinger, Bot. Zeit. 1847, p. 198; Species Algarum, p. 294; Tabulæ Phycologicæ, t. 99. fig. 11.

Ditches and pools. Near Carnarvon and near Barmouth, *J. R. France, Lenormand*.

Sphærozyga leptosperma occurs in large, shapeless, gelatinous masses in still waters. Its colour varies from deep green to pale yellowish green, but when the filaments are comparatively few it is nearly colourless. The ordinary joints are longer than broad, separated only by transverse dissepiments, which are not contracted, and indeed are often so obscure, that, in the recent state, they can hardly be detected, whilst the filaments, in all respects but their enlarged cells, appear not unlike those of an *Oscillatoria*. Vesicular cells at first barrel-shaped, finally elliptic, and as broad as the sporangia, the early state of which they somewhat resemble, but they may be recognized by the absence of granular contents and by their globules. Sporangia cylindrical, four to six times longer than broad, truncate, slightly broader than the ordinary cells.

The confluent ordinary cells with their obscure dissepiments distinguish *Sphærozyga leptosperma* from every other British species.

PLATE VIII. fig. 13. Mature filament.

DOLICHOSPERMUM, *Thwaites MS.*

Filaments simple, generally moniliform, aggregated into a gelatinous stratum; sporangia interstitial, elongated, separated from the vesicular cells by the ordinary joints.

Dolichospermum differs from *Sphærozyga* only in the different arrangement of its cells. In the latter genus the vesicular cells connect the sporangia, whereas in the former they are situated amongst the ordinary cells.

The sporangia are much elongated and mostly cylindrical. They are developed from the ordinary cells, which are more or less remote from the vesicular ones. Mr. Thwaites finds that their extremities are invariably truncated, and the endochrome escapes in an undivided mass, a circumstance he has not noticed in the other genera belonging to the *Nostochineæ*.

This genus is distinguished from *Cylindrospermum* by the interstitial position of the sporangia and vesicular cells, and from *Trichormus* and *Spermosira* by its elongated sporangia.

1. *D. inæquale* (—). Filaments moniliform; ordinary cells at first quadrate, finally orbicular; vesicular cells large, spherical; sporangia linear, catenate.

Boggy pools. Dolmelynlyn near Dolgelley, *J. R.*

This plant forms extensive strata, composed of thick gelatinous masses of a deep green colour. Filaments elongated, consisting of from 100 to 200 cells, and, being stouter than in most species belonging to this family, visible to the naked eye. Ordinary cells distinct, quadrate in immature specimens, but at length nearly spherical, appearing punctate on account of the scattered granular matter which they contain. Vesicular cells spherical, broader than the ordinary joints and occurring at short intervals. Sporangia three or four times longer than broad, with truncate ends, in chains of from two to five members.

Dolichospermum inæquale may be known from the following species by its spherical vesicular cells and catenate sporangia.

PLATE IX. fig. 1.

2. *D. Ralfsii* (Kützinger). Filaments moniliform; ordinary joints spherical; vesicular cells elliptic; sporangia elliptic or cylindrical, one or two in each series. *Cylindrospermum Ralfsii*, Kützinger, Bot. Zeitg. (1847), p. 197; Species Algarum, p. 293; Tabulæ Phycologicæ, t. 98. fig. 7.

Bog and rivulet at Llyn Gwernan near Dolgelley, *J. R.*

Dolichospermum Ralfsii occurs in extensive strata of a velvety rich dark green colour, sometimes verging towards æruginous green. A portion placed in water threw out, in the course of one

night, rays an inch or more in length. Filaments elongated, comparatively stout, visible to the naked eye, under the lens full green when grouped, but bluish green when scattered. Ordinary joints orbicular. Vesicular cells elliptic, broader than the ordinary ones. Sporangia near the middle of each series of ordinary joints, most frequently solitary, rarely more than two together, at first oval, afterwards oblong, finally cylindrical, and about six times longer than broad. In their early state they resemble the vesicular cells in form; but the presence of granular matter and the absence of junction-globules reveal their true character: the longer ones are frequently contracted at the middle, a circumstance I have occasionally noticed in those species which have elongated sporangia.

Dolichospermum Ralfsii is distinguished from *D. inæquale* by its elliptic vesicular cells (which are comparatively less broad), by its more orbicular ordinary joints and by having fewer sporangia.

PLATE IX. fig. 2.

3. *D. Thompsoni* (—). Filaments spirally curved; ordinary and vesicular cells spherical; sporangia oblong, curved, usually solitary. *Anabaina Flos-aquæ*, Harvey, Manual of Brit. Algæ, p. 186 (1841); Hassall, British Freshwater Algæ, p. 282. t. 75. fig. 2.

“Floating like powdered verdigris on one of the small Lochs Maben, Dumfries-shire,” Mr. W. Thompson.

A specimen of this plant, given me by Mr. Thompson, forms on paper a thin stain of a bluish green colour. Filaments moniliform and loosely spiral. Ordinary and vesicular cells orbicular, and so much alike in form and size that in the dried state I am unable, with absolute certainty, to distinguish the latter from ordinary cells which have lost their granular matter. Mr. Thwaites however informs me, that by a careful adjustment of the lens, he has detected the puncta in the vesicular cell, in which also he finds the membrane firmer than in the others. Sporangia solitary (rarely two together) in each series, two or three times longer than broad, curved, so as to appear somewhat reniform, and more rounded at their ends than is usual in this genus.

This species is easily distinguished from the others by its curved filament and reniform sporangia. Its moniliform, spiral filament agrees better with *Trichormus* than with *Dolichospermum*, but in its elongated sporangia it differs from every species of the former.

PLATE IX. fig. 3.

4. *D. Smithii** (Thwaites MS.). Filaments straight, each included in

* For the description of this and the following species I am indebted to Mr. Thwaites.

a definite gelatinous sheath; ordinary cells subspherical, compressed, about as long as wide; vesicular cells subspherical, somewhat barrel-shaped, half as wide again as the ordinary cells, puncta very distinct; sporangia cylindrical, very unequal in length, and with the ends rounded and somewhat truncated.

Occurring amongst other algæ from a freshwater boggy pool at Wareham, Dorsetshire, *Rev. W. Smith*.

D. Smithii is immediately distinguishable from its congeners on account of its possessing a definite gelatinous sheath to each of its filaments, which are of smaller diameter than those of any other species of *Dolichospermum* we are now describing. The ordinary cells are subspherical, somewhat compressed, and of less diameter than the vesicular cells, which are barrel-shaped and with very distinct puncta. The numerous sporangia, which are of about twice the diameter of the ordinary cells, are elongated and cylindrical, very variable in length and in the number which occur together, and their ends are slightly truncate.

PLATE IX. fig. 4.

5. *D. Thwaitesii* (—). Filaments straight or nearly so; ordinary cells quadrate; vesicular cells oblong, subquadrate, puncta very distinct; sporangia numerous, cylindrical, with truncated ends, very variable in length. *Sphærozyga Ralfsii*, Thwaites in lit. (1849).

In a freshwater pool, Dendham Down near Bristol; also in a brackish ditch near Shirehampton, *G. H. K. Thwaites*.

D. Thwaitesii is nearly allied to the foregoing species, but its filaments are not included in a definite gelatinous sheath. Its filaments are also stouter than those of *D. Smithii*, and there is a difference in the form of its ordinary as well as of its vesicular cells. The vesicular cells of *D. Thwaitesii* are quadrangular, and hardly exceed in diameter the ordinary cells. The cylindrical truncated sporangia are numerous, occurring many in a chain, and very variable in their length; they are of about twice the diameter of the ordinary cells.

PLATE IX. fig. 5.

CYLINDROSPERMUM, *Kützinger*.

Filaments simple, jointed, nidulating in a gelatinous stratum; vesicular cells terminal; sporangia oblong or elliptic, interposed between the vesicular and ordinary cells.

(*Anabaina*, Bory and others.)

In *Cylindrospermum* the stratum is similar to that described under the preceding genera; but as the filaments radiate less than is usually the case in *Sphærozyga*, I was, in one instance of admixture, enabled to separate the *Sphærozyga* from the *Cylin-*

drospermum, by availing myself of the greater radiating capacity of the former.

The filaments, as in the other genera, have at first all their joints uniform, but the terminal joint at each end soon enlarges into a vesicular cell, which is either orbicular, elliptic or ovate, and is generally furnished with fine scattered hairs or fibres: the penultimate joints then elongate and become cylindrical, afterwards they increase considerably in breadth, and when mature are always elliptic or elliptic-oblong. Sometimes two or even three sporangia are formed between the vesicular and the ordinary cells. The additional sporangia however are not uniformly present even in filaments from the same stratum, and are sometimes double at one extremity and not at the other; in fact, few mature specimens can be examined without observing examples of these variations. Hence, although the doubling of the sporangia occurs more abundantly in some specimens or species than in others, I cannot rely upon it as a specific distinction.

There can be no difficulty in recognizing this genus under the microscope. The filaments, especially when only one extremity is visible, are remarkable for their animal-like appearance. The chain of ordinary cells resembles a slender-jointed body; the enlarged elliptic sporangium, at least twice as broad as the remainder of the filament, represents the thorax, and the head is mimicked by the vesicular cell, which, in colour, shape and general aspect, differs from the other cells, whilst the presence of fine hairs renders the imitation more perfect.

It will thus be seen that the terminal cells are invariably vesicular, the penultimate ones always become sporangia, and the central ones remain unaltered.

When the filaments break up, the sporangia separate from the ordinary cells, but remain for some time crowned by the vesicular ones. The filament in *Sphærozyga* frequently breaks at the vesicular cells, after which the portion retaining one attached to its sporangium, appears, at first sight, to belong to this genus. In the recent state however the slightest attention will show its true character, for the vesicular cell of the broken *Sphærozyga* retains the punctum or globule at each end, which is not the case in *Cylindrospermum*, as it is only present where another cell has been conjoined.

1. *C. catenatum* (—). Filaments moniliform; ordinary joints orbicular; vesicular cells oval; sporangia oval, catenate.

This species was probably gathered in South Wales, but I omitted to note the habitat when the specimens were preserved.

Stratum bluish green; filaments very fine, elongated, straight or slightly flexuose, generally parallel. Ordinary cells orbicular,

numerous, very minute. Vesicular cells oval. Sporangia (two to eight in each chain) at first similar to the ordinary cells, but usually less orbicular; finally they become more or less oval, the shorter ones approaching to orbicular, and the longer ones to oblong; they are frequently but little broader than the vesicular cell; in fact their size never differs so much as in many species.

Cylindrospermum catenatum differs from every other species in its numerous sporangia.

Cylindrospermum contains many other species, several of them by no means uncommon in this country; but their descriptions must be deferred to some future period, as my friend Mr. Thwaites, who had paid great attention to them, was prevented by his appointment at Ceylon from fulfilling his kind promise to describe them for this paper.

PLATE VIII. fig. 14. *a*, immature filament; *b*, mature state.

APHANIZOMENON, Morren.

Filaments simple, flaccid, obsoletely jointed, "cohering laterally into flat lamellæ," aggregated into a mucous stratum; vesicular cells none; sporangia linear, interstitial.

(*Aphanizomenon*, Morren. *Limnochlide*, Kütz.)

Aphanizomenon forms a thin, tender, mucous stratum of a bluish colour. The filaments are extremely slender, flaccid, and very obscurely jointed. No vesicular cells have been detected. The sporangia are much elongated, either scattered or, more usually, solitary near the centre of the filament.

I have examined an authentic specimen of *Limnochlide Flos-aquæ*, and as there seems to be no essential difference between *Aphanizomenon* and *Limnochlide* I have united them, retaining the former appellation on account of its priority. The filaments in both genera are described as cohering in flat lamellæ, but that character is sometimes so little obvious in dried specimens, that I am not inclined to place much dependence upon it as a generic distinction, especially as I could not detect it in recent specimens of a plant, presently to be described, which I think should by no means be placed in a different genus.

Authors differ widely respecting the proper situation of this genus. In Harvey's 'Manual of British Algæ' it is placed at the end of the *Conserveæ*, Montagne appends it to the *Oscillatorieæ*, Endlicher omits it altogether, and Kützinger instituted for it a distinct family, which he placed between *Leptotricheæ* and *Nostochineæ*. Mr. Hassall, I believe, first placed it in this family, and I fully concur with his observation that "the true position of the genus is undoubtedly amongst the *Nostochineæ*, connecting them with the *Oscillatorieæ*."

Aphanizomenon agrees in its filament with *Oscillatoria*, but is sufficiently separated by its conspicuous sporangia, which are similar to those of *Dolichospermum*. It differs from all the other genera in the *Nostochineæ* by the absence of vesicular cells and by its obsoletely articulated filament.

1. *A. Flos-aquæ* (Linn.). Filaments cohering laterally in flat lamellæ which separate at their extremities into fasciculi; sporangia cylindrical with an inconspicuous covering. *Byssus farinacea virescens, aquæ inspersa*, Linnæus, Flora Lapponica, no. 532 (1737), ed. 2nd, p. 388 (Smith, 1792); Flora Suecica, ed. 1st, no. 1128. *Byssus Flos-aquæ*, Linn. Species Plantarum, no. 1168 (1753), ed. 2nd, p. 1637. *Conferva Flos-aquæ*, Roth, Catalecta Botanica, fasc. 3. p. 192 (1806). *Oscillatoria Flos-aquæ*, Agardh, Synopsis Algarum Scandinaviæ, p. 107 (1817); Syst. Algarum, p. 59. *Nostoc Flos-aquæ*, Jürgens, Algæ aquaticæ. *Limnanthe Linnæi*, Kützing in Linnæa, vol. xvii. p. 86. *Limnochlide Flos-aquæ*, Kützing, Phycologia Generalis, p. 203 (1843); Phycologia Germanica, p. 168; Species Algarum, p. 286; Tabulæ Phycologicæ, t. 91. fig. 2a. *Aphanizomenon incurvum*, Allman in lit. cum specimine.

Probably not uncommon. Grand Canal Docks, Dublin, Professor Allman.

Sweden, Linnæus; Germany, Kützing.

I am indebted to Professor Allman for a beautiful and characteristic specimen of this species. In its dried state the stratum appears to be composed of minute flocculi, and, with the exception of colour, might not unaptly be compared to scattered snow-flakes. The colour is opaque, æruginous green, which however becomes more or less altered after being dried a second time. The microscope shows that the flocculi consist of parallel filaments united together laterally, and forming a flat layer which appears plumose from the filaments converging at the ends into little conical or subulate tufts or pencils. The filaments are straight, obtuse, not attenuated; the joints are rather longer than broad, faintly visible, and especially difficult of detection in consequence of their granular contents. Kützing describes the sporangia as elliptic. In the Dublin specimen they are few in number and immature; but in specimens given me by Professor Kützing they are linear, much elongated, often ten or twelve times longer than broad, and resemble those of the next species except in having a far less conspicuous hyaline covering. The best distinctive mark between these species is the lateral coherence of the filaments in *A. Flos-aquæ*.

In the dried state, the only condition in which I have seen it, the *Aphanizomenon Flos-aquæ* is easily recognized by its flocculent appearance, even to the naked eye. I believe that not only was it one of the earliest-known plants in this group, but that it

is the true *Flos-aquæ* of almost every algologist prior to Lyngbye, whose error has misled many succeeding writers and confounded plants of widely different aspect. The descriptions of Linnæus, Roth and Agardh, although more or less deficient, agree far better with this species than with any others which have been confused with it. Lyngbye, indeed, suspected that his *Nostoc Flos-aquæ* was distinct from the plant of the two latter writers*, an opinion confirmed by Agardh so far as regards himself. Mr. Borrer has sent me a specimen of *Byssus Flos-aquæ* distributed by Mohr, who, there is every reason to suppose, was fully acquainted with the plant then known by that name: the specimen, which is a very good one, scarcely differs even in colour from those recently gathered by Professors Kützinger and Allman.

I cannot obtain the slightest clue to the *Flos-aquæ* of our earlier British writers. They give no habitats, and although the specific definition of Hudson, Lightfoot and Withering agrees with this species ("filamentis plumosis natantibus"), yet, as it is a mere copy from Linnæus, no dependence can be placed upon it. The two former authors give no original remarks, and Withering's own observations agree but indifferently with his specific quotation; for his description, "jointed filaments straight or curled like a corkscrew," is more applicable to a *Trichormus*.

PLATE IX. fig. 6. *a*, portion of foreign specimen magnified; *b*, Dublin sp. ditto; *c*, filaments highly magnified.

2. *A. cyaneum* (——). Filaments free, aggregated into a thin mucous stratum; sporangia linear, eight to twelve times longer than broad, furnished with a conspicuous hyaline covering. *Limnochlide Flos-aquæ*, β . *hercynica*, Kützinger, Species Algarum, p. 286 (1849); Tabulæ Phycologicæ, t. 91. f. 11?

On aquatic plants in boggy pools at Llyn Gwernan and Dolmelynlyn near Dolgelley, *J. R.*

Germany, Kützinger.

Stratum minute, thin, tender, of an opake light blue colour. Filaments very slender, straight, nearly colourless, having a slightly dotted appearance from the scattered granular endochrome, not constricted at the dissepiments, which are very indistinct, and only to be detected by careful examination in a favourable light; ends obtuse, not attenuated. Joints or ordinary cells nearly equal in length and breadth. Sporangia elongated, cylindrical, generally solitary near the centre of each filament, but sometimes scattered, each inclosed in a broad, hyaline covering.

* "An sit *Conferva Flos-aquæ*, Roth, *Oscillatoria Flos-aquæ*, Ag., justo ambigitur; illæ enim filis rectis et parallelis gaudere describuntur, hæc vero filis curvatis, implexis instructa est."—Lyngbye, Tentamen Hydrophytologiæ Danicæ, p. 202.

Aphanizomenon cyaneum differs from *A. Flos-aquæ* by its stratum not appearing flocculose, by its paler inconspicuous filaments, which do not cohere in laminæ, and would often escape detection under the microscope but for the presence of the sporangium, which has a far broader hyaline covering in this than in the latter species.

PLATE IX. fig. 7. Filament highly magnified.

3. *A. incurvum* (Morren). "Filaments articulated, cohering together in flat laminæ, lacinated at the apex; articulations two to eight times longer than broad." *Trichodesmium Flos-aquæ*, Ehrenb. in Poggend. Annal. 1830, p. 168 (according to Kützing). *Aphanizomenon incurvum*, Morren in Memoir (1837); Thompson in Annals of Nat. Hist. vol. v. p. 82; Harvey, Manual of Brit. Algæ, p. 145; Hassall, Brit. Freshwater Algæ, p. 280. t. 76. fig. 6. *Limnochlide Flos-aquæ* γ. *Harveyana*, Kützing, Species Algarum, p. 286 (1849); Tabulæ Phycologicæ, t. 91. fig. 2.

Ballydrain Lake, Mr. W. Thompson; Lough Neagh, Mr. D. Moore. Belgium, Morren; Germany, Kützing.

I regret that I am unable to afford any satisfactory information respecting this plant, for although Mr. Thompson has supplied me with specimens, they are unfortunately preserved upon paper, and could not be removed in a condition fit for examination. Respecting the Ballydrain species, one would suppose there could be no reasonable doubt as Dr. Morren has determined it. Still it is very possible that his *Aphanizomenon incurvum* has been rightly supposed by Kützing to be merely the *Flos-aquæ*, for nothing in the descriptions renders the opinion improbable. The Dublin plant at least is decidedly the *A. Flos-aquæ*. Mr. Thompson's *A. incurvum* however differs materially from all my specimens of the *A. Flos-aquæ* both in colour and in the form of the particles, which are circular and dot-like, very unlike the larger and lobed flakes of the other. Mr. Hassall's figure represents the filaments as tapering—a character, indeed, amply sufficient to distinguish the *A. incurvum* from the preceding species; but unfortunately, if the filaments really possess this character, neither Dr. Morren nor Mr. Hassall have noticed it in their descriptions, and so the matter is still in doubt.

Since the above was written, I have received from Mr. Moore some specimens better suited for examination. Although not from the same station as Mr. Thompson's plant, they exactly agree with it in appearance; the specks are unlike any other species that I have seen, and in form as well as in size and scattered habit resemble the small dots made by house-flies. Under the microscope the filaments appear parallel; they do not closely cohere as in *A. Flos-aquæ*, but are rather held together by the

mucous matrix, and are neither fasciculated nor lacinated at their ends; they are so very slender that the triplet is not sufficiently powerful to afford a proper examination. I was unable to perceive either dissepiments or sporangia. In no respect, except in their parallel arrangement, did the filaments correspond with Morren's description.

PLATE IX. fig. 8. *a*, portion of stratum from Lough Neagh; *b*, filament.

XXX.—On *Trichites*, a fossil genus of *Bivalve Mollusks*.

By JOHN LYCETT, Esq.*

[With a Plate.]

THIS generic form is distributed over an extensive area both in this country and upon the continent; it occurs in more than one of the oolitic formations; the Cotteswold Hills more especially produce it abundantly; nevertheless it is almost entirely absent from the cabinets of English collectors; and if we examine that section of modern literature which professes to illustrate fossil conchology, our search will scarcely be more successful or satisfactory. In both cases the defect may be accounted for by a difficulty almost insurmountable experienced in obtaining illustrative specimens in a condition perfect, or even approaching to perfect; fragments indeed are easily detached, but these alone do not convey any precise or adequate idea of the generic characters.

The shells are large, the very Titans of their period, sometimes extending to upwards of a yard across, of a thickness far surpassing that of bivalves generally, but of a structure peculiarly fragile (prismatic crystalline), consisting of fibres closely arranged, placed perpendicularly to the surface and breaking readily in the direction of the fibres with any slight concussion; this is a serious obstacle to their separation, to which may be added, that the upper ragstone bed of the Inferior Oolite in which they most commonly occur is very hard and intractable in the nature of its fracture. In almost every open quarry of this rock, and more especially in the stratum called Trigonia grit, these thick fibrous masses may be noticed; more rarely also in the middle portion of the same formation and in the shelly beds of the Great Oolite. They have usually been referred to a gigantic species of *Pinna*, probably from a similarity of structure. The Cotteswolds have produced two species, which are distinct from another recorded from the Jura which will subsequently be noticed. Dr. Plott, the historian of Oxfordshire, appears to have been the first person who applied the term *Trichites* to these shells. Woodward,

* Read to the Cotswold Naturalists' Club, Jan. 22, 1850.

in his 'Catalogue of English Fossils,' 1725, part 2. p. 101, 102, 'De testis aliisque incerti generis,' mentions that Lhwyd sent a specimen of this genus from the Oolite of Bullington Green near Oxford, with the title "*Trichites Plottii*," Hist. Oxon. Veneris crines forsán Plinio," and adds the caustic remark, that these two writers, Dr. Plott of mere simplicity, and Lhwyd of design, "darken counsel by words without knowledge," Job. xxxviii. 2; he also records fragments in his collection from Risington and Birdlip Hill in Gloucestershire. The generic name was of course derived from its capillary or hair-like structure. Far from joining in the foregoing censure, we are rather disposed to respect the discrimination which recognized this obscure generic form in the earliest infancy of conchology. It was observed by Saussure in the Coralline Oolite of Mount Salève near Geneva, and described by Deluc in the first volume of the great work of Saussure on the Alps, p. 192, and figured in part 2. fig. 5, 6. This eminent naturalist ascertained some of the general features of the genus; the great thickness of the test, its fibrous structure, analogous, he observed, to that of *Pinna*, and its inequivalve form; this latter character, he observed, compelled a generic separation, and he proposed to call it *Pinnegene*. Deluc seems to have been unacquainted with the prior claim of Lhwyd. Guettard and De-france observed it in the oolitic rocks of Normandy; they regarded it as a distinct genus, but do not appear to have contributed anything material to its elucidation. The latter author's views are contained in an article contributed by him to the 'Dictionnaire des Sciences Naturelles,' tom. lv. 1828.

Deshayes, in his last edition of Lamarck's Conchology, does not recognize its generic value, but describes Deluc's species (tom. vii. p. 68) under the designation *Pinna Saussurei*; the materials at his disposal seem to have been very imperfect, and in consequence his description is incomplete and calculated to give an erroneous idea of its characteristic features. The term 'subæquivalvis' for instance does not accord with Deluc's figures; it is stated to gape posteriorly, which, judging from our specimens, must be an error; the character of the terminal extremity and interior of the hinge-line are not mentioned. The only other recent notice of the genus which we have discovered is contained in the volume of Dr. Pictet, which is devoted to fossil conchology, where the figures of Deluc are copied on a reduced scale, but no additional information is given. From the absence of all notice of the genus by the leading systematic writers on conchology, it may be concluded that they did not recognize the distinction of Deluc's shell from *Pinna*, or having no personal knowledge of the form, they hesitated to allow it a place with recognized genera. It has therefore hitherto existed almost on

the horizon of science as an obscure and problematical object, which it will be our present endeavour to bring more nearly within the grasp of the conchologist.

Generic Character.

Shell of fibrous structure, thick, ovate, oblong, inequivalve, inequilateral and irregular; umbones terminal, produced and funnel-shaped, the apex gaping. Hinge-margin oblique and elongated, the margins undulated, anterior margin corrugated and thickened beneath the umbones. Hinge lateral, linear and without teeth.

Our specimens, though not numerous, exemplify the genus in a satisfactory manner, and place its characters free from ambiguity. The valves are both separated and in apposition; in one instance the interior of the cardinal border and terminal extremity have been cleared, but the muscular impressions have not been seen. The general figure is oblique and nearly quadrilateral, one valve being convex, the other flattened or even a little concave; the margins undulate, are rather irregular, including even the hinge-line, and there is always a considerable undulation occupying the posterior border, at which part the valves are thinner, more expanded and flattened; the undulations of both valves correspond; they are rounded, having no posterior truncation, and when closed leave no hiatus. In the concavity of the anterior border is a corrugation which marks the probable place of exit for a byssus, a feature exactly corresponding with that in *Perna*, *Avicula*, &c., but there is scarcely any distinct hiatus perceptible. The umbones form a hollow funnel-shaped cavity narrowing to the extremity, but open, the opening being rounded, and formed by the termination of both the valves; the shell about its middle and anterior parts attains a thickness exceeding any recent bivalve, and comparable only with the fossil genus *Catillus*; the smaller valve is the thinnest. With respect to its affinities, that to *Pinna*, which has engaged the attention of naturalists, would appear, to say the least of it, to be very remote. What do we find in conformity with a delicate, almost papyraceous shell, straight, equivalve and regular, with a truncated, widely gaping posterior extremity? Absolutely nothing; on the contrary we have a shell of monstrous thickness, very oblique, inequivalve and irregular, its posterior side being neither truncated nor gaping—in fact nearly every generic feature of importance is reversed; the fibrous structure common to both seems to have misled observers into a supposed generic identity. But even the structure of the two genera when carefully examined presents a difference equally marked and characteristic: the strength of

the thin and delicate *Pinna* is produced by a double structure, by its substance consisting of two layers, the outer being fibrous, the fibres placed perpendicular to the surface as in *Trichites*; but the inner one is nacreous or lamellar, a contrivance which effectually obviates the fragility which pertains to the fibrous structure. *Trichites* on the contrary has one structure throughout; the perpendicular fibres are crossed by a few extremely fine parallel laminae, which do not break off the continuity of the fibres, and impede fracture only to a very limited extent. The genus *Catillus*, found only in the cretaceous rocks, is that which seems to approximate most nearly to the present form. Both have very much the same general figure, fibrous structure and thick substance; on the other hand, the *Catilli* are nearly equivalve and regular, the hinge consists internally of a linear series of crenulations, and the terminal character of the umbones is likewise distinct.

The position of *Trichites* in the conchological series should therefore be near to *Catillus*; its irregularity is such that no two of our specimens are exactly alike either in outline, convexity or surface. Two individuals were nearly covered with small adherent shells, a sufficient indication that their habits were sedentary or sluggish. The great fragility is certainly not the effect of fossilization, but a consequence of its structure, and must always have existed; the condition in which the shells are found presents a sufficient confirmation of this idea. After frequent and persevering, but for the most part fruitless exertions with the hammer and chisel, we are enabled to state that *Trichites* usually occurs in the state of distinct portions or fragments, and that entire individuals are rare; the fracture too not unfrequently is found across the thickest part of the test. A mollusk, whose shell was thus constituted, could scarcely have been the denizen of a shelly beach within the influence of the tide, or exposed to frequent rolling and collisions with other fragmentary bodies; its habitat must have been tranquil, and probably covered deeply and defended by soft mud or sand. Specimens which occur in the chaotic shelly beds of the Great Oolite, locally termed 'planking,' may be regarded as travelled, and, as might be anticipated, are usually in portions only, and these seldom large; individuals perfect or approaching to perfect are the exceptions to the rule. In the upper portion of the Inferior Oolite the conditions of seabottom appear to have been somewhat different; there is an absence of shelly detritus; the valves of the Conchifera are most frequently in apposition, and *Trichites*, as far as can be ascertained, appears more frequently to approach to the perfect condition.

EXAMPLE.

Trichites nodosus. Plate X.

(Great and Inferior Oolite.)

Shell quadrately curved, with longitudinal waved nodose ribs; ribs few, diverging, some bifid. The larger valve convex, the lesser rather concave, with nodules nearly obsolete, disposed in two concentric series.

Our specimens differ much in the degree of convexity and character of the ribs, the latter being occasionally scarcely distinguishable; the terminal umbones are very much curved and turned forwards. The planking beds of the Great Oolite at Minchinhampton Common and freestone of the Inferior Oolite near to the same locality produce it, but it has not been recognized in the upper portion of the Inferior Oolite; from the intractable character of that rock, however, this circumstance must not be considered as conclusive of its absence. Our examples in point of size convey but a very inadequate notion of the magnitude often attained by the genus; but it would appear that the larger sections belong to the second, or possibly even to a third and more gigantic species. The *Pinna Saussurei* (*Pinnegene* of Deluc) is distinct from our Cotteswold shells; his figures, taken from specimens broken and partly enveloped in the stone, do not convey any precise idea of the external form, but the portion which exhibits the character of the surface is altogether different.

Trichites undatus.

(Inferior Oolite.)

Shell oblong; umbones . . . ; ribs obscure, few, concentric, irregular and undulated, sometimes obsolete in the larger valve.

The smaller valve unknown.

Length 9 inches, breadth $7\frac{1}{2}$ inches.

The only well-preserved example in our possession has lost the terminal extremity, but in other respects is nearly perfect; the hinge-line is more nearly horizontal than in the *T. nodosus*, and the entire form is less convex; the other valve, though attached, cannot be cleared from the hard matrix. It occurs abundantly in the upper ragstone of the Inferior Oolite, a rock which usually defies all attempts to separate the shell in a tolerable condition; in this instance a large portion of the surface fortunately coincided with the natural parting of the bed.

XXXI.—*Characters of nine new or imperfectly described species of Planorbis inhabiting India and China.* By W. H. BENSON, Esq.

1. *Planorbis hemisphærule*, Cantor MSS.; Benson, Ann. Nat. Hist. vol. ix.

Testa nitida, olivaceo-cornea, leviter exilissime radiato-striata, subdiaphana, supra valde convexa, spira planulata, apice vix depresso; sutura impressa; anfractibus $4\frac{1}{2}$, ultimo extus declinato, majusculo, inferne obtuse subangulato, intus laminis raris radiantibus munito, subtus excavato; umbilico mediocri profundo, margine subangulato; apertura obliqua subcordata, margine superiori arcuato, prominente, inferiori recedente.

Diam. major 6 mill., minor 5, axis vix 3 mill.

Hab. in insula Chusan Imperii Sinensis. Theo. Cantor.

In describing this shell I formerly omitted any notice of the internal laminæ, which indicate an approach to the more regular structure observable in the English *Pl. lineatus* (*segmentina* of Leach), as they were not very apparent through the substance of the shell in the specimen examined, and are not visible in the aperture. This species as well as *Pl. papyraceus* of the same paper having been originally named by Dr. Cantor, will retain his name as the authority, although the asterisks denoting that circumstance have been too indiscriminately placed, as in the case of *Helix ravida*, mihi, and *Novaculina (Solen) constricta*, Lamarek.

2. *Planorbis Calathus*, nobis, n. s.

Testa nitidiuscula, albido-cornea, vel lutescente cornea, subdiaphana, exiliter radiato-striata, supra convexa, versus apicem planulata, apice concavo, sutura impressa; anfractibus 4, ultimo extus depresso, inferne angulato, intus laminis denticulisque radiatis frequentioribus munito, subtus subplanulato, versus umbilicum angustum, profundum excavato; apertura obliqua, cordato-sagittata, intus remote labiata, margine superiori arcuato, prominente, inferiori subrecto, recedente.

Diam. major $4\frac{2}{3}$, minor 4, axis 2 mill.

Hab. in lacubus Bhimtal et Neini Tal, regionis Kemaonensis Himalayanæ; necnon in stagnis nonnullis agri Rohillani, prope urbem Moradabad, Indiæ septentrionalis.

In a note to a paper on the singular genus *Camptoceras*, and on the minute Melaniadous genus *Tricula*, contained in the 'Calcutta Journal of Natural History' for 1842, I noticed the unusual structure of this species, but omitted to add a specific description. The shell belongs to the same type as the Chinese forms above described, and with the English species *Pl. lineatus*, and the Bengal *Pl. trochoides*, forms a fourth species of analogous but varying internal structure.

It is a very local species, but abundant in the places indicated. Besides size, it differs from the Chusan species in sculpture, in its more angular form at the periphery, and in its less excavated lower disc, and narrower umbilicus. It is somewhat singular that the only species of *Planorbis* which have been observed with internal laminæ, should inhabit such widely separated localities as westernmost Europe, the eastern part of Asia (both of them insular situations), the north-western part of India, and the mouth of the Ganges. *Planorbis umbilicalis*, nobis (Journ. As. Soc. vol. v.), an allied Bengal form, is utterly destitute of any internal teeth or laminæ, as is also the species next to be described.

3. *Planorbis cænosus*, nobis, n. s.

Testa nitida, luteo-cornea vel olivaceo-cornea, oblique et rude (præcipue subtus) radiato-striata, subdiaphana, supra depresso-convexa; spira parvula, apice excavato; sutura impressa; anfractibus $3\frac{1}{2}$, ultimo majori, extus depressiusculo, inferne carinato, subtus planato, versus umbilicum majorem leviter excavato; apertura obliqua, sagittiformi, margine superiori arcuato, prominente, inferiori recedente, recto.

Diam. maj. vix 6 mill., minor 5, axis $1\frac{1}{2}$.

Hab. in stagno prope urbem Moradabad, agris Rohillanis.

Less abundant and still more confined in locality than *Pl. Calathus*. The specimens taken by Dr. Bacon and myself were supposed to be merely a large variety of that species, but on clearing them, lately, from a thick ochreous deposit with which they were disfigured, I perceived that not only were they destitute of internal laminæ, but that the shells were more depressed and more angular at the keel, and that the relative proportions of various parts differed.

4. *Planorbis Cantori*, nobis, n. s.

Testa nitidula, cornea, subdiaphana, radiato-striata, depressa, supra convexiuscula, spira planata, apice concavo, sutura bene impressa; anfractibus $5\frac{1}{2}$, convexiusculis, lente crescentibus, ultimo antice majori, subtus convexo, periphæria subcarinata; umbilico aperto, profundiusculo; apertura obliqua subcordiformi, margine supra valde arcuato, fuscato, infra leviter rotundato.

Diam. maj. 7, minor $6\frac{1}{4}$, alt. 2 mill.

Diam. spiræ $3\frac{1}{2}$; lat. anfract. ult., antice, 3 mill.

Hab. in stagnis Bengalensibus prope castra Barrackpore. Teste Theo. Cantor.

This shell, of a sublenticular form, is intermediate between the subtrochoid species and the more symmetrical smaller *Planorbis*. It comes much nearer to *Pl. convexiusculus*, Hutton, Journ. As. Soc. Calcutta, July 1849, than *P. umbilicalis*, nobis, which, from the tenor of his foot-note in page 657, Capt. Hutton has never seen. The forms of the European and American shells with

which I compared it, and the slope of the last whorl, underneath, towards the penultimate whorl, independently of other characters noted, ought to have indicated that the description was quite inapplicable to *Pl. convexiusculus*, which is wound on a regularly increasing open spiral, instead of rapidly increasing in the breadth of the last whorl. This rapidity of increase, but in a less degree, is observable in *Pl. Cantori*. *Pl. umbilicalis*, moreover, could never, by possibility, have been overlooked among examples of *Pl. compressus*, as Capt. Hutton states to have been the case with his Pinjore specimens of *Pl. convexiusculus*.

5. *Planorbis labiatus*, nobis, n. s.

Testa solidiuscula, plano-depressa, nitida, albido-cornea, subdiaphana, oblique arcuato-striata, striis remotiusculis spiralibus decussata; apice profunde concavo; sutura profunda; anfractibus $3\frac{1}{2}$, cito crescentibus, convexis, ultimo antice majori, ab axe superiorum discedenti, rotundato, carina mediana levissima submembranacea instructo, infra valde convexo; umbilico subaperto profundiori, margine interiori subangulato; apertura obliqua, cordiformi, intus albo-labiata; margine superiori arcuato, inferiori rotundato.

Diam. maj. 5, minor 4, axis vix 2 mill.

Hab. in stagno prope urbem Moradabad. Inter specimina *Pl. compressi* (Hutton) detexi.

This little shell is remarkable for the departure of the last whorl from the axis which governs the previous volutions. This is especially apparent underneath, where the earlier whorls in the umbilicus proceed regularly, the last whorl becoming suddenly excentric. The whitish rib within the lip is also a marked character, as well as the proportion of the axis to the diameter.

6. *Planorbis Sindicus*, nobis, n. s.

Testa minuta, perforata, sublenticulari, albida, lævi, subdiaphana, supra convexa; spira planulata, apice depresso; anfractibus $2\frac{1}{2}$, ultimo medio obtuse angulato, subtus convexo; apertura cordata, obliqua, margine superiori arcuato, prominente, inferiori recedente.

Diam. $2\frac{1}{2}$ mill.; axis $\frac{2}{3}$ mill.

Hab. in fluvio Indo, regione Sindica superiori.

This very distinct and minute species, remarkable, after *Pl. trochoides*, nobis, for its small umbilicus, but of a less trochoid, and more lenticular form, I found adhering to the inside of a specimen of *Paludina Bengalensis* sent to me, with other shells common to the Gangetic Provinces, from the banks of the Indus above Sukkur, by my friend Major FitzGerald, Bengal Cavalry, from the expedition which accompanied Shah Shujah under Lord Keane to Cabul. No other specimen appears to have been met with.

7. *Planorbis rotula*, nobis, n. s.

Testa minuta, depresso-planata, apertissime umbilicata, luteo-cornea, diaphana, impolita, spiraliter obsolete striata; anfractibus $3\frac{1}{2}$, cylindraccis, lente horizontaliter increscentibus, supra et subtus æqualiter apparentibus; ultimo ad periphæriam rotundato, nullo modo angulato; sutura supra infraque profunde impressa; umbilico minime profundo; apertura vix obliqua, rotundato-lunata; margine superiori arcuato.

Diam. maj. $2\frac{2}{3}$, minor 2, paulo plus, axis 1 mill.

Hab. in agro Rohillano, prope urbem Moradabad, raro occurrens.

This is the most agile freshwater mollusk which has ever fallen under my observation. I discovered it in 1841, on high ground westward of a house belonging to the Nuwab of Rampore at Moradabad, which became flooded during heavy rain, and which had no communication with tank, marsh, or other body of water. The shells must have lain under ground during at least nine months in the year, and I failed to find them in the same spot at the corresponding season in subsequent years. The little animal suspended itself below the surface in the shallow water, and projected itself at a rapid rate by a series of quick and sudden jerks, the disc of the shell acting below as a kind of oar. The sudden starts called to mind the manner of the oceanic *Pteropodes*. The motions of *Pl. compressus* and other allied species exhibit nothing similar. I had ample opportunities of ascertaining this point from having kept *P. compressus* for months in a glass vase in which I watched its habits. *Pl. rotula* is thus enabled to escape from the drying-up shallows, and to enjoy, for as long a period as possible, its short-lived liberty, which a slower mode of progression would much tend to abridge.

The inaccessibility of the work, in which I originally described the two following species, to the generality of readers, induces me to take advantage of the present opportunity of redescribing them more fully. Comparative remarks on the species, and other observations on the genus, will be found on reference to the journal quoted.

8. *Planorbis umbilicalis*, nobis.

Testa polita, luteo-cornea, subopaca, leviter radiato-striata, supra convexa, spira planulata; apice concavo; sutura impressa; anfractibus 4, ultimo extus depresso, majusculo, inferne obtuse angulato, infra planiusculo, majori, versus umbilicum subapertum, profundum declivi; apertura obliqua, subcordata, margine superiori arcuato, prominente, inferiori recedente.

Diam. major 7 mill., minor $5\frac{1}{2}$, axis $2\frac{1}{2}$.

Diam. spiræ 3 mill., anfr. ult. 4, supra.

Pl. umbilicalis, Benson, Journ. As. Soc. Calcutta, 1836, vol. v. p. 741-2.

Hab. in rivis Bengalix orientalis.

9. *Planorbis trochoides*, nobis.

Testa vix perforata, diaphana, nitida, inconspicue radiato-striata, subtrochiformi, convexa; spira parvula, arcte convoluta, concava; sutura profunde impressa; anfractibus $3\frac{1}{2}$, penultimo valde convexo, ultimo majori, versus suturam obtuse angulato, extus depresso, inferne acute carinato, intus laminis rarissimis plerumque munito, subtus planato, medio, versus umbilicum inconspicuum, leviter excavato, versus periphæriam vix declivi; apertura obliqua, subsagittata, margine superiori arcuato, prominente, inferiori recedente.

Diam. 3 mill., axis vix 2.

Pl. trochoides, Benson, Journ. As. Soc. vol. v. p. 742-3.

Hab. in hortis palatii proregalis apud castra Barrackpore Bengalæ. Specimina pauca detexi.

The infrequency and irregularity of the internal laminæ in this species, causing them to look more like accidental thickenings of the shell, made me overlook this structure in my original description. The species is singular from the nearly total absence of umbilicus, and from its rendering nugatory, as far as this species is concerned, the characters of the genus "anfractibus omnibus utraque conspicuis," and "apertura ab axe remotissima;" but for the reason stated in the work referred to, its removal from the genus *Planorbis* appears inexpedient, and the subsequent discovery of a species, proximate in this respect, in *Pl. Sindicus*, confirms my formerly expressed opinion.

It is desirable to observe, that in all the above descriptions I have treated the shells as practically dextral, with reference to the true position of the animal contained in them.

April 10th, 1850.

XXXII.—*Observations on the Littorinidæ*:

By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Norfolk Crescent, Bath, April 2, 1850.

I OFFER for the consideration of malacologists a tolerably complete memoir on the true *Littorinidæ*; that is, I have given descriptions of the types of each genus. This account was written during the summer months of the last year, 1849, after a protracted examination of many hundreds of, I may say, nearly all the varieties of *Littorina rudis*, which have long occupied a position as species, to which it will appear they are not entitled. In close connection with this subject is a very short correspondence

between Professor Forbes and myself. I have no copies of my letters, for it has always been an irksome task to me to copy what I write; I trust to memory; and if I have misdated any point, I humbly submit to correction. As Professor Forbes's letter is strictly malacological, I feel confident, from his well-known liberality, that he will not consider an apology necessary for the insertion of the following extract:—

“West Lulworth, near Wareham, Dorset, Nov. 1849.

“I should like to know what opinion you have come to respecting the specific value of the forms of the *Littorinæ* you enumerate. For my part I can only recognize *Littorina littorea*, *L. petraea*, *L. neritoides* and *L. rudis*. I am in doubt however whether *L. jugosa* should not also be held distinct.”

Being in a position to answer decisively, I wrote to the effect, that having carefully examined nearly all the animals of the varieties termed by authors *L. tenebrosa*, *L. jugosa*, *L. zonaria*, *L. rudissima*, *L. fabalis*, *L. neglecta*, &c., I found them to be identical with each other, and mere varieties of *L. rudis*, and consequently that that portion of the genus *Littorina* consisted, agreeably to his views, of only *L. littorea* and *L. rudis*; I however added, that I believed the *Lacunæ*, not excepting *L. crassior*, were confined to one or two species. As the genus *Littorina* has long been the dépôt of many of its varieties improperly promoted to species, it occurred to me that a good opportunity offered itself for making a few remarks, with the view of checking, if possible, this inconvenient practice, by pointing out the great detriment that resulted to science from the fabrication of species on insufficient grounds. I have been wishing for an apt opportunity to emit my paper, which only occurred in the April Number of the ‘British Mollusca,’ wherein malacologists will observe that Professor Forbes with singular coincidence corroborates with his views, mine, written many months ago, from actual examination of the animals. Though the learned Professor has admitted into his work varieties that have not the slightest pretensions to be styled species, for the sake of exciting further investigation of them, yet in page 52 of his summary of the *Littorinæ*, he boldly and emphatically repudiates all paternity with the pseudo-species. He says—

“In the preceding account of the *Littorinæ* several are described as species which many of our ablest naturalists regard as varieties, whilst others are considered as varieties which some hold to be worthy of specific rank; our conviction is, that the result of a completed knowledge of this genus would be a reduction in the number of true British species. Taking the most permanent features of the animal and its shell as our guide, we are

inclined to reduce the true specific types to *L. neritoides*, *L. littorea*, *L. littoralis* and *L. rudis*."

My views being thus supported, I send forth without hesitation these observations made long ago, and I feel gratified that my investigations of this tribe have received the corroboration enunciated by that eminent Professor.

Before I give the descriptions of the types of the genera of the *Littorinidæ*, I will make some remarks on the prevalent practice of naturalists to create species from mere varieties: this anxiety can only be attributed to their wish to extend our knowledge of new and interesting objects: that these views are desirable and laudable cannot be questioned, but it is to be feared that the zeal of these gentlemen, combined with the ardour of rivalry in the race with their brethren in the same pursuits, have been the cause of a departure from those principles and laws which are considered indispensable to arrive at just conclusions in the establishment of genera and species; or in other words, in laying down the true bases of the differential features of the families, genera and species of a class, so as to enable the student to deposit his objects with certainty in their natural position, and to distinguish them from others, however numerous, of the same family, by concise and well-defined specialties. If these rules were rigorously attended to, we should have fewer complaints of the almost impossibility of identifying many of the objects of natural history. The inconveniences that have arisen from the neglect of these precepts are so great and pressing, that I propose to attempt to point out their origin, and suggest a remedy as far as regards malacology and conchology, and to evidence and illustrate my arguments by references to the present state of certain groups of the Mollusca.

If conchologists are determined to form numerous species from mere varietal conchological indicia, they must have their way, but malacologists will not concur with them to give a dozen names to the same animal. These gentlemen cannot escape having the phrase "*Dies docebit*" verified; the day of retraction will assuredly arrive; it will therefore be better for the interests of science and their *amour propre*, at once to apply the remedy for this singular creative monomania,

. . . . "O medici mediam pertundite venam."

I apologise for my irreverent quotation, and trust I may claim for this once,

. . . . "Liberius si
Dixero quid, si forte jocosius, hoc mihi juris
Cum veniâ dabis."

The practice I have just described is fraught with great detri-

ment to the advancement of science, because in many instances it destroys every attempt at identity, and renders our books bulky and expensive by the insertion of worthless synonyms, which have no existence as objects ; and every writer feels obliged to notice all, because he has not the means of separating the rigorously defined and well-founded species from the pseudo and unsubstantial articles. It results from this false position of the science, that when a student, with his object in hand, consults the authorities, he finds ten or twelve others so nearly resembling his, that he becomes bewildered in the mazes of distinctions often without differences, despairs of identifying his object, and perhaps retires altogether from a rational and highly important pursuit, under the idea that the science is full of perplexities, which he, as a tyro, has neither time nor inclination to unravel.

The unsatisfactory state of this branch of natural history originates in the practice of determining specific distinctions from the *shell* or a *half* of the animal ; these are consequently arbitrary and artificial ; and though in decided forms this plan may produce correct results, it signally fails when structures begin to shade into each other ; then the sheet-anchor, the animal, can alone solve doubts, and often shows that shells apparently well-marked by specific distinction are not in reality distinct, and *vice versâ*.

This neglect to consult the most important, the soft parts of the animal, has in some measure been occasioned by the supposed difficulties of procuring living objects for examination, and a disinclination to enter into the imaginary repulsive details of dissection and anatomical inductions ; every day's experience diminishes these obstacles. Naturalists may be assured that every attempt to establish specific identity, without taking into account both the hard and soft parts of the animal, will be unsatisfactory and deceptive. The unpleasant operations of anatomy to persons of great sensibility may often be dispensed with, and in the majority of cases of *specific* discrimination are unnecessary.

Every person, even ladies, can deposit animals in sea-water and describe their habitudes and external organs, as the head, tentacula, eyes, and how they are placed, whether at the external or internal bases of the tentacula, and if on pedicles, what is their proportion to the length of the tentacula, the shape of the foot, operculum, the mouth, and coloration of the animal, &c. ; these points, with the sculpture of the shell, will in almost all cases ensure specific distinctions, and consequently remove the inconveniences of the arbitrary creation of species on conchological bases.

I see with pleasure that the system I advocate has received a

great impulse from that valuable work, 'The British Mollusca,' wherein the learned Professor and his coadjutor have boldly broken through the trammels of the old system, and as far as possible, founded the classification on natural organization, and at a great expense of arduous research, though still from necessity retaining hundreds of unmeaning and worthless synonyms, expunged and weeded out a multitude of exotic species which disfigured and almost choked up our indigena; these are great services, and every naturalist in this line will feel a lively satisfaction, that by these aids he can now pursue a delightful study agreeably to the order of nature. A new æra has commenced in British malacology; it stands disenthralled from arbitrary and defective dispositions, and in future will march hand in hand with its elder sister, conchology. And lastly, that I may not be misunderstood on the subject of the varieties, I beg to state, that I consider the mention of all, very desirable and of great importance as *varieties*, but not as *species*, and on this point I give an extract from a deservedly high authority. M. Philippi says, "Semper varietates sedulo notavi, hoc etiam valde necessarium duxi, cum auctores qui in musæis modo conchyliis describunt, id minus apte facere possint, quam ille qui centena specimina in maris littore ipse colligit et observat; sed nimium plerumque colori, aliisque notis variabilibus, dignitatem tribuant, aut ætates diversas pro speciebus diversis sumant, sicut ex. gr. multoties clarissimus Risso fecit." This opinion is expressly given *sub modo*, that especial care is to be taken that varieties are not inserted as species.

It now remains by examples to illustrate and impress on the minds of young naturalists the value and pressure of the preceding observations. Perhaps a stronger case of the improper multiplication of species on frivolous grounds cannot be brought forward than that of the genus *Anomia*, which, as I believe, only contains a single British species, the *Anomia ephippium*, the mere varieties of which have constituted the sixteen or seventeen species that are consigned to our conchological annals, and are based on the arbitrary and artificial distinctions of colour, the various adscititious markings, and forms resulting from the substances on which they are fixed, combined with the influencing effects of habitat, food, and depth of water.

I have the last summer examined and dissected 500 *Anomie* of all forms, sizes and colours from different habitats, and in the endless variety of colour and markings of this proteiform genus I have not discovered a single specific character, either as regards the anatomy or external organs of this genus, that would justify the creation of a single species. I have now done with the *Anomie*, as the learned editors of the 'British Mollusca' have, though

without any particular concurrence therein, recorded these opinions in their interesting work. But in corroboration of these views I shall adduce some considerations on another genus, which has largely contributed to the increase of pseudo-species; I allude to that portion of the genus *Littorina* designated *L. littorea* and *L. rudis*.

I now take a rapid glance at the family of the *Littorinidæ*, and then conclude my paper by giving the notes and specific descriptions of the types of each genus as proofs, and in support of what I have advanced, and to afford data to malacologists to come to just conclusions on what I have submitted to their consideration.

LITTORINIDÆ.

This well-known family as now constituted consists of the genera *Lacuna*, *Assiminia*, *Rissoa*, and *Littorina*. The *Lacunæ* of authors are scarcely distinguishable from the *Littorina littoralis*; the animals are all but identical, and the two genera appear to be separated on conchological grounds,—the groove in the columella rather than an animal distinction. I think it would conduce to the interests of science if the *Lacunæ* were merged in the genus *Littorina*, and marched *pari passu* with *Littorina littoralis* as species.

I shall show malacologically, in a memoir I am preparing on the *Lacunæ*, that the difference of the animal of *Lacuna* and *Littorina littoralis* is scarcely appreciable. The *Lacunæ* have only one or two species instead of the eight or ten of authors.

Assiminia was established by Mr. Gray, and differs chiefly from the *Rissoa ulvæ* and *R. subumbilicata* of Montagu, in having the eyes fixed at the extremities of the tentacula, in consequence of being placed on adnate pedicles of concurrent length.

The *Rissoæ* are very minute; they inhabit the littoral and laminarian zones; the types of the first zone are the *Rissoa ulvæ* and *R. subumbilicata*, and of the second *R. parva*. These are true littoral *Rissoæ*. Many minute shells which conchologically appear *Rissoæ* inhabit only the coralline zones, and as most of the animals are unknown, the true relations between the animals of the littoral and coralline districts are not as yet satisfactorily ascertained.

Littorina has only four species, *L. littorea*, *L. rudis*, *L. neritoides*, and *L. littoralis*.

I now proceed to the specific descriptions:—

Assiminia, Gray and Leach.

Assiminia Grayana.

Animal spiral, yellowish brown; mantle simple; head with a

moderately long deeply-cloven annulate muzzle. Eyes at the extremities of pedicles soldered to the shortish blunt tentacula, being of concurrent length with them; a canaliferous groove runs from their bases to the branchial cavity. Foot large, broad, auricled, truncate in front, with an obtuse posterior termination, double-lobed; the upper one, being much the smaller, carries the usual horny suboval spiral operculum of the *Littorinæ*. It inhabits in sufficient abundance the small streams which discharge into the Greenwich marshes, but generally within the reach of the tidal and brackish waters.

Rissoa ulvæ.

R. ulvæ,
R. subumbilicata? } Montagu.

Animal spiral, varying in colour from locality from nearly black to pale brown; mantle plain; the head is a long dark probosciform muzzle, emarginate in the centre in front, marked with two transverse bars, and its margins edged with the same dark colour; mouth pale brown or yellow with a vertical fissure; tentacula very long, cylindrical, slender, pointed, of a frosted or setose whitish yellow, with a black bar at a short distance from their termini; eyes at the external bases on short thick offsets; the foot is short, truncate and auricled in front, rounded, and slightly, in some individuals, emarginate posteriorly. In the lighter colour variety the upper part is a pale brown, and beneath yellowish white with a border of minute pale golden flakes, with sometimes a dark bar running through the centre of its posterior part. In the darker variety the upper part of the foot is clouded with very fine dark lead-colour to its paler hues, underneath pale brown. It carries a light suboval corneous operculum. These animals creep with great rapidity, and float with the foot uppermost by means of an hydrostatic apparatus, as air-bubbles are seen continually to proceed from the aperture; they are strictly littoral, and inhabit in myriads the green ooze of the estuaries.

I have no hesitation in consigning this species to the genus *Rissoa*. It differs in many points from the true *Littorinæ*, especially in having the foot short, truncate, auricled in front, and rounding to an obtuse point behind; its under surface is not subdivided as in *L. littorea*; it has the entire aspect of the foot of the *Rissoæ*, except that it has not the posterior filamentary appendage; nevertheless there are the rudiments of it in the present species; and in its progression it has not a trace of the oscillatory action so conspicuous in the foot of the typical *Littorinæ*, which I believe never swim, but the *Rissoæ* in general are oftener seen floating in a reversed position than otherwise.

The shells of this section of the *Rissoæ* are subject to great

variety from locality, varying in number and in the inflation of the volutions, and in colour from pale brown or yellowish white to dark red-brown or horn-colour. I think that one of the light varieties with the tumid volutions is Montagu's *Turbo subumbilicatus*, which species appears to be in great obscurity. Having carefully examined the animals of all the varieties, I can decidedly state that they are identical with the typical *Rissoa ulvæ*. I am much inclined to think that the *Rissoa Barleei* is one of the varieties.

Rissoa, Fréminville.

Rissoa parva, Mont. et auctorum.

R. costulata.

R. rufilabris.

R. scalariformis.

R. interrupta, &c.

Animal spiral; mantle plain, just even with the shell; the head is a short dark brown muzzle, cloven with a vertical orifice beneath, the disk of which is yellow; tentacula long, slender and cylindrical, yellow, with a longitudinal row of white detached flakes, and often the reverse, white, with yellow interrupted flakes; eyes on short offsets at the external bases. Foot flaky-white above and beneath, long, narrow, truncate in front, slightly auricled; the point is blunt, from whence a small upper lobe or membrane springs, on which is fixed a suboval corneous operculum with spiral loose striæ, and at its extremity a single short white tentacular filament is seen. The branchial plume consists of 15-18 minute vessels attached under and to the mantle and back of the neck.

This is another of the genera the conchologists have taken possession of for the manufacture of varieties into species. The type *Rissoa parva* is a most variable species, resulting from locality and other causes. The animals of all the varieties enumerated above are identical; we have examined them all, and can find no appreciable difference except varieties of colour and occasional variations in the length of the terminal filament, which is never in any two selected shells precisely similar. The *R. costulata* is an elongated variety; the *R. rufilabris* a short tumid one, with a red or pink peristome, which may often be seen in its congeners. The *R. interrupta* is a more slender, thin, less plicated, dwarf variety. The *R. scalariformis* has the plicæ more numerous, white and delicate; and lastly, the typical *Rissoa parva* varies so much that it is difficult to find two shells alike. These varieties live in company in the lower levels of the littoral zone, but are more plentiful at the borders of the laminarian district.

Littorina, Férussac.*Littorina neritoides*, Linnæus.*Turbo petraeus*, Montagu et aliorum.

Animal spiral; mantle even with the shell; the head is a long proboscidiiform cloven muzzle, the upper part of an intense black cloud-colour; orifice of the mouth white with a vertical fissure; tentacula awl-shaped, moderately long, flattened; eyes large, not on pedicles, but placed on the substance of the skin at the bases of the tentacula, inclining externally only in a trifling degree. The buccal mass is plain brown, supported by two thin coriaceous plates of the same colour, from whence a very long white spiny tongue proceeds to the stomach, and there lies coiled as in *Littorina littorea*; but it is proportionately longer than in that species, being 2 inches long. Foot nearly as in *L. littorea*, very slightly auricled and curved in front, rounded posteriorly to a terminus, which is a little jagged or dentated, forming an oval when not in action, but on the march a very elongated oval; above its colour is black; underneath a pale lead ground mixed with two shades of white and one of purple. These colours are divided into three portions; the anterior one is the narrowest, of an intense hyaline white, the middle is also hyaline, and the third is hyaline pale purple. The foot is not strictly divided into two longitudinal half-parts as in *L. littorea*, but at the anterior part, where the intense hyaline white terminates, appears transversely broken or furrowed, so as to allow of a subdued alternate undulatory gait, or quality of progression, something like that of *L. littorea*, in which the whole of the longitudinal half is first advanced, and then the other; but here only half of the anterior part of the foot is moved forward, and then the other, and so on, dragging the other part in alternate times.

This alternate action of parts of the foot is a very singular character, which obtains, more or less, in all the true *Littorinae*, and is with very few exceptions confined to that genus. There is only one branchial plume, and the internal and external organs are nearly those of *L. littorea*. The sexes are distinct in all the Pectinibranchiata. I ought to have mentioned the suboval corneous dark operculum, pointed superiorly with about two rapidly increasing gyrations, the nucleus being at the basal end.

This species is one of those that inhabit the highest levels of the littoral zone, and often dwells for an indefinite time far beyond even the spray of the sea. It appears a mystery how the branchiæ are kept moist; I suspect the minute saline particles carried by the winds suffice, especially as the long exposure to atmospheric influences has almost rendered the branchiæ of pulmoniferous quality. They clothe the rocks in myriads on the

South Devon coasts. I sum up, and conclude the present species to be a true *Littorina*.

I omit a description of the animal of the very common *L. littoralis*, which I reserve as a standard of comparison for my memoir on the animals of the *Lacunæ*.

Littorina littorea, auctorum.

This exceedingly common, but very curious and interesting animal, has not met with the attention it deserves; we are sure that we shall afford gratification in producing a detailed account of it.

Animal spiral; mantle simple, exactly lining the aperture of the shell; the head is long, cylindrical, not deeply cloven; mouth a vertical fissure, and with the neck and tentacula are marked on their upper surfaces on a yellow ground, with very close-set dark transverse lines, which, with the lead-colour anastomosing longitudinal waved markings, give the animal almost a black appearance. The tentacula are moderately long, conical, pointed, very tumid at their bases, black above, white beneath, on which, a little raised, the eyes are set externally. The foot is a very singular organ, short, rounded before and behind, scarcely auricled, and when in action forms an oblong suboval disk, divided by a central sunken line into two longitudinal lobes, which, when the animal marches, are each advanced *alternately* with an undulating vermicular motion. This curious longitudinally divided foot and peculiar locomotion are only to be found in one or two other genera; they are particularly conspicuous in the *Phasianella pullus*. The under part of the foot is yellowish white, bordered by a deep line at a little distance within the margin, from which fine transverse ones radiate, giving the foot the appearance of being encompassed by a fine fringe; the upper posterior part carries a dark, corneous, suboval operculum, with about two turns of elliptical striæ, and a very excentric nucleus. The buccal apparatus is a deep red fleshy mass, supported by two thin coriaceous plates, between which, in ordinary-sized animals, a long, at least two inches, riband-like white spiny tongue issues, passing down the œsophagus, and becomes closely coiled in the stomach; its termination is tinged with red; immediately behind the buccal mass is the œsophageal cordon, which consists of only two white subrotund flattish ganglions, one on each side, and behind them are the salivary glands, each formed of a mass of foliaceous granules; there is only one branchial plume, of light yellow, attached to the left side of the mantle and neck of the animal; the verge is a large flat organ grooved longitudinally, ridged transversely, dentated on one side with two points, one below the other, the lower one with

a minute orifice; the female is oviparous; the antepenultimate whorls are always flat in this species, being a condition resulting from the shape and size of the ovarium, which is only adapted for *ova*; it is however much more prolific than the *Littorina rudis* and varieties.

This is the common edible periwinkle of the London markets, and the only one, as the females of the *L. rudis* and all its varieties are viviparous, and cannot be used for food in consequence of the grittiness arising from craunching the testaceous pulli; it is found in all situations often exposed to the full influences of an open sea, but more usually in estuaries and muddy inlets, which are also the habitats of certain varieties of the *L. rudis*; it grows to $1\frac{1}{2}$ inch in length and 1 inch diameter.

Littorina rudis, Donovan.

L. tenebrosa, *L. zonaria*, *L. rudissima*, *L. jugosa*,
L. patula, *L. neglecta*, *L. fabalis*, *L. saxatilis*, and, } auctorum.
 sub fide Forbesii, *L. palliata*, &c., }

This well-marked species has nearly the same organs as *L. littorea*; I have compared the nervous ganglions and other internal parts of both forms, without finding distinction. To enumerate the greater part of the other organs, in comparison with those of *L. littorea*, would be a repetition; I will only mention the essential specific distinction, which is, that in the females of this species the large bulky ovarium is usually filled with strings of testaceous pulli; that is, if they are examined at the season when, O! Alma Venus, thy votaries are “*perculsæ corde tua vi*,” the ovaries fill up the tumid antepenultimate volutions. The markings and colours of the animal have the same character as those of *Littorina littorea*, except that they are much less intense; but though closely allied, it is very particularly distinguished by the much higher littoral level of its habitat, the greater tumidity of the volutions, colour, and above all by the very different ovarium, its contents and mode of reproduction. It rarely exceeds an inch in length and three-quarters of an inch in diameter.

To describe the varieties enumerated above, which are the pseudo-species of authors, would be to say, that the organs of all, both internal and external, do not vary in the slightest degree in form; the only differences are modifications of colour, size, and in the striæ, depending entirely on habitat. The *L. rudis*, *L. tenebrosa*, *L. zonaria* and *L. rudissima* are usually inhabitants of the estuaries and muddy oozes, and rarely exposed to the full action of an open sea.

We earnestly recommend naturalists in their respective localities to consign the four species above-named to basins of water, together with all the dwarf varieties inhabiting the crevices of

rocks, when they will at once perceive that they are all identical with each other and the type *L. rudis*, and will afford a practical proof that species founded on the characters of the shells are artificial and delusive, and that the soft parts must also be considered to obtain specific distinction.

The *L. rudis*, and all the varieties, are extremely impatient of continued immersion in water; when deposited in basins, the first object is to escape therefrom and attach themselves to a dry spot. In estuaries, where they are often affused by the fresh water, they become, particularly the *L. tenebrosa*, thin and depauperated in their shells; they are sometimes for weeks deprived of even being sprinkled by sea water. Though decided Pectinibranchiata, they live in the open air with nearly equal facility as the Pulmonifera; and in reference to this fact, as regards another family, the *Conovuli*, there are still malacologists, who, notwithstanding the valuable observations of the Rev. T. Lowe, are not quite satisfied that they are pulmoniferous; we have ourselves attempted to corroborate Mr. Lowe's views, but failed from want of sufficient specimens.

The *L. littorea* is the only species of this particular form that requires, to attain full growth, a regular bi-hodiernal immersion in sea water, and to obtain it the bulk of that species live in the lower littoral levels; if they are deprived of it, they become stunted and dwarf.

That variety of the *L. rudis* which is undoubtedly the *L. jugosa* of Montagu varies from quite smooth to highly striated, and has even ridged, reflected, spiral volutions, as are represented in the figure of Montagu's 'Testacea Britannica;' it clothes the interstices of rocks on the Devon coasts in myriads; they are rarely or never immersed, as they dwell in the same highest littoral levels, in most exposed situations, in like manner as their congeners the *L. rudis* and *L. tenebrosa* inhabit the highest levels of the sheltered and protected estuaries. They are the parents of all the dwarf varieties, the *L. patula*, *L. subsaxatilis*, *L. neglecta* and *L. fabalis*, &c.

As a proof that habitat is the cause of these dwarf varieties of the *L. rudis*, I mention that the *L. littorea* in company with them, at a few yards' lower level, are small, stunted, and nearly as dwarfish. By the favour of Mr. Bean of Scarborough I have compared his *L. zonaria*, *L. rudissima*, *L. neglecta* and *L. fabalis* with Devon specimens, and found them identical; consequently I presume the animals are so likewise.

These so-called species are without exception viviparous. How happens this singular coincidence? how is it that none of them follow the plan of the reproduction of the other species? This is a very significant fact, and is, I think, a strong circumstance, in conjunction with the positive similarity of the animals, in favour

of my position, that the spurious species belong to *L. rudis*, and of course follow the habitudes implanted by nature in the parent. It may be asked, does not the very important fact of the viviparous reproduction of *L. rudis* and its varieties indicate something more than specific distinction? I partook of this opinion, but on consulting a naturalist of the highest authority, he informed me, that in the lower classes, the fact of an animal being viviparous, without other circumstances, when its congener was ovoviviparous, did not constitute sufficient grounds for generic distinction. The question is open, and I leave the solution of this problem to those who are better versed than myself in the mysterious laws of nature which relate to the genesis of the Mollusca.

I could adduce many more examples of various values, of the sad confusion that has crept into and disfigured this highly interesting department of natural history, from the introduction of phantoms into our records, instead of soundly settled species. I refrain, and rest for the present on the great examples I have adduced in illustration of these observations, on the principle that "omne majus in se minus continet." If the preceding remarks have the effect of causing greater circumspection in future in the creation of species, the object I have had in view will be accomplished.

I am, Gentlemen, your most obedient servant,
WILLIAM CLARK.

POSTSCRIPT.—I take this opportunity to refer to some species of Mollusca which have lately been mentioned in our records. Having obtained fifty specimens of the *Trochus pusillus* of authors, I am enabled beyond doubt to state, that it is the living prototype of the fossil *Delphinula nitens* of M. Philippi, tab. 25. fig. 4, and that the *Skenea Cutleriana* discovered by me is scarcely distinguishable from M. Philippi's *Delphinula elegantula*, also a fossil, tab. 25. fig. 3; the only distinction is, that the spiral striæ of *Skenea Cutleriana* are twice as numerous as those of *D. elegantula*; this may arise from habitat, but I think the two distinct. The *Trochus exilis* of Philippi has not the slightest approach to *S. Cutleriana*. Whatever generic appellation may ultimately be applied to the *Skenea divisa* of authors, the same must belong to the *S. Cutleriana*, as the character of the capillary striæ is precisely similar. They are not *Trochi*, and I believe the *Trochus pusillus* is a *Skenea*; I shall however soon have an opportunity of deciding, by seeing the animal. I am enabled to state that the *Modiola phaseolina* is a mere variety of *Modiola modiolus*, which when young, and indeed at all ages, varies both in shape and lustre.—I have fresh proofs of the fixity of the Foraminifera which shall appear shortly.—W. C.

XXXIII.—*Notices of British Fungi*. By the Rev. M. J. BERKELEY, M.A., F.L.S., and C. E. BROOME, Esq.

[Continued from vol. ii. Ser. 2. p. 268.]

[With two Plates.]

380. *Pilacre faginea*, Berk. & Br. Stipite nigrescente pruinoso; capitulo subgloboso; sporis buxeis. *Onygena faginea*, Fr. Syst. Myc. vol. iii. p. 209. On beech sticks, Spye Park, Wilts, Aug. 1844, C. E. Broome.

About 2 lines high. Stem $1\frac{1}{2}$ line high, pruinose, at length brown or blackish. Head subglobose or turbinate, at first pruinose, umbilicate or (in our specimens) without any trace of an umbilicus; flocci branched, especially above, somewhat fastigate, more or less flexuous; spores minute, broadly elliptic, with a distinct nucleus.

This appears to be nearly identical with specimens from Ohio gathered by Mr. Lea, and with others from the Santee river, South Carolina, collected by Mr. Ravenel. In these latter however, though the outward resemblance is perfect, the flocci are not fastigate, but are strongly curled and frequently anastomose; the spores in either are exactly the same. We have seen no authentic specimen of the plant of Fries. The structure of a very similar fungus from Valais, for which we are indebted to Dr. Montagne, is totally different, resembling that of some compound *Oidium*. The species has little in common with *Onygena* except external appearance.

PLATE XI. fig. 5. *a*. Flocci and spores magnified; *b*. a single spore more highly magnified.

381. *Lycogala parietinum*, Fr. *l. c.* vol. iii. p. 83. *Didymium parietinum*, Schrad. Nov. Gen. p. 24. t. 6. f. 1. On damp paper, old willow baskets, &c., King's Cliffe.

382. *Didymium melanopus*, Fr. *l. c.* vol. iii. p. 114. On bramble, Speke Hall, Lancashire, 1842, M. J. Berkeley.

383. *D. tigrinum*, Schrad. Nov. Gen. p. 22. t. 6. fig. 2, 3. *Phy-sarum tigrinum*, Fl. Dan. t. 1434. fig. 1. On mosses and Jungermanniæ, Bolton Woods, Wharfedale, R. Spruce, Esq., Dec. 1841.

Our plant agrees precisely with the 'Flora Danica' species, which has stouter stems than that of Schrader, but which Fries considers identical. The same species has been kindly sent by M. Lenormand from Falaise.

384. *D. congestum*, n. s. Congestum, stipitibus submembranaceis hyalinis, vix botryosis; peridiis obovatis elongatis; sporis atris floccis candidis variegatis. On dead leaves, grass, &c., King's Cliffe; also in Upper Carolina.

Forming crowded patches very much resembling those of *Diachea elegans*. Peridia obovate-oblong, cinereous, with a white mealy coat; stems hyaline, membranaceous, generally distinct though crowded, springing from a thin subjacent membrane. Spores black, variegated with the white, coarse, irregular, here and there lacunose flocci.

The lower figure in 'Fl. Dan.' t. 1973. fig. 1, is probably a representation of the species before us, which is evidently widely diffused. The plant represented in the upper figure with a separate membranous outer peridium seems to be quite different. At any rate our plant is no *Diderma*, and could not have been placed by Fries in that genus. We are compelled therefore to consider it as undescribed. The globose spores appear at first sight to be granulated, but on closer inspection the granules are found to arise from the disintegrated outer peridium. It may be mentioned that in *D. Spumarioides* the flocci are black.

385. *D. dædaleum*, n. s. Stipitibus brevibus coalitis peridiisque dædalino-connatis sinuatis pallide lateritiis albo farinaceis; floccis candidis; sporis atro-purpureis. In great abundance in a cucumber-frame, Milton, Norths., Mr. J. Henderson, April 26, 1843.

Spreading far and wide in little subglobose masses; stems reddish brown, inclining to orange, connate, as if composed of a mass of little flat bran-like membranes; peridia connate, sinuated, forming a dædaloid mass of the same colour as the stem, but sprinkled with white meal and having to the eye a grayish tinge from the contained spores, which are purplish black, smooth and globose, variegated with the white flocci, which are frequently forked and vary greatly in width, being in parts broad, flat and membranous:

A very beautiful species allied to *D. fulvipes*, but differing evidently in its white flocci and other particulars.

386. *Stemonitis Physaroides*, A. & S. p. 103. t. 2. fig. 8. On mossy stumps of trees, Northamptonshire.

Our specimens have a beautiful coppery tinge, but are doubtless referable to the species cited above. We have precisely the same thing from Ohio.

387. *S. violacea*, Fr. l. c. vol. iii. p. 162. On different species of moss: common.

We have gathered this near Cambridge and in Somersetshire, and it has been sent to us from Shropshire by Mr. Leighton, and from Berwick by Dr. Johnston.

388. *Enerthenema elegans*, Bowm. in Linn. Tr. vol. xvi. p. 151. t. 16.

Perfect specimens of this very curious production have lately been transmitted by the Rev. M. A. Curtis from Lower Carolina,

which show that it is quite distinct from *Stemonitis papillata*, the spores being produced in little heads surrounded by a common vesicle at the free apices of the flocci, which all spring from a disc at the top of the percurrent stem. No such structure exists in *S. papillata*. The genus therefore may be thus characterized:—

Peridium simplex tenuissimum membranaceum fugax evanescens. Capillitium determinatum e membrana stipitem coronante cum peridio continua oriens. Sporæ globosæ 5–6 ad liberos apices floccorum conglomeratæ vesicula communi circumdatæ.

The structure is in *Myxogastri* precisely what that of *Elaphomyces* is in *Lycoperdineæ*, and would perhaps go far towards justifying the retention of that genus amongst the puff-balls, reminding one of the strange anomaly observed by Messrs. Tulasne in the fructification of a species of *Hymenogaster* and of the vesicular heads of *Mucorini*. This is almost the only case in which the spores of a *Myxogaster* have been observed *in situ*; *Ptychogaster* is the single exception, and in that Corda represents them as forming little heads.

PLATE XI. fig. 7. Flocci with spores and cysts highly magnified.

389. *Arcyria umbrina*, Schum. Sæll. vol. ii. p. 213; Fl. Dan. t. 1975. fig. 1. Wothorpe, Norths., on wood.

It does not seem to have been noticed that in this genus the threads of the capillitium have a row of little tubercles on one side only, or if not confined to one side, some of them are more strongly developed. In some instances they form rings round the threads.

390. *Trichia Ayresii*, n. s. Congesta; peridiis obovatis castanco-fulvis nitidis; stipitibus brevissimis connatis; capillitio fortiter echinulato sporidiisque crocato-fulvis. On decayed wood, Thame, Oxfordshire, Dr. Ayres.

Forming crowded masses. Peridia obovate, shining, of a bright tawny chestnut. Elaters of the capillitium thicker than in *T. pyriformis* and strongly echinulate, tawny. Spores globose, tawny.

This differs from *T. pyriformis* in the much thicker strongly echinulate elaters, which in that species are at first sight apparently smooth, as indeed they are represented by Corda. *Trichia Neesiana*, Corda, is referred by Fries in his 'Summa Vegetabilium Scandinaviæ' to *T. rubiformis*, with which view we are inclined to accord.

391. *Trichia serotina*, Schrad. Journ. Bot. 1799, vol. ii. p. 67. t. 3. fig. 2. Bristol, H. O. Stephens, Esq.

392. *Licea perreptans*, Berk. Effusa, demum hic illic conglomerata; peridiis oblongis ut plurimum distinctis; sporis atropureis, Berk. in Gard. Chron. 1848, p. 451. *Lycoperdon echiniformis*, Sow. ! Fung. t. 400. fig. 1. In great abundance in

a cucumber-frame heated with spent hops, Rolleston, Staffordshire, Mr. Townshend. Found also by Mr. Sowerby.

Hypothallus white, creeping far and wide, and protruding here and there masses of oblong peridia, which are mostly distinct; assuming gradually a reddish brown tint, and in cases of premature exsiccation becoming black. Spores very abundant, purple-brown, mixed with a few flocci.

This very curious species, which is analogous to *Reticularia maxima*, is of extremely rapid growth. When to all appearance completely destroyed, in twelve hours it was again as vigorous as ever, involving everything at first in a slimy and then in a dusty mass. Its mode of growth is that of *Licea fragiformis*; the spores however are quite different, and the mucilage never acquires the beautiful strawberry tint of that species. An opportunity of inspecting good authentic specimens of the plant of Sowerby cited above, shows that it is identical with our plant, and not with *Reticularia maxima*, Fr., a species which has however occurred at Apethorpe, and is therefore to be retained in the British Flora. It has smaller, darker and more exactly globose spores, besides possessing the filaments proper to *Reticularia*. Ignorance of the real structure of Sowerby's plant at the time the species was published in the Gardeners' Chronicle prevented the adoption of his specific name, which it is now too late to restore.

393. *L. applanata*, Berk. Depressa conglomerata; peridiis brevissimis arete connatis rufis; sporis magnis. Berk. in Hook. Lond. Journ. vol. iv. p. 67. On dead twigs of currant, &c., Somersetshire, C. E. Broome; Apethorpe, Norths.

Forming little, thin, flat, distinct rounded or elongated patches, which are at first scarlet and then liver-brown. Peridia short, densely crowded, invisible to the naked eye. Spores large, broadly elliptic with one or more nuclei, argillaceous, tinged with red, mixed with a few flexuous threads very much larger than in *L. fragiformis* or *L. cylindrica*.

The spores in the Swan River specimens described in Sir W. J. Hooker's Journal are of the same size, but have a more distinct border, and occasionally but not always a single nucleus. The Australian specimens, it is to be observed, are scarcely mature, and in consequence the colour of the spores is brighter, though now, after some years' sojourn in the herbarium and after repeated application of turpentine and corrosive sublimate, they can scarcely be called saffron-coloured. These differences are trifling, and arise probably from little peculiarities of condition. We have no doubt of the identity of the British and Australian species.

394. *Phoma asteriscus*, n. s. Uniloculare convexum piceum

margine nebuloso ; sporis oblongis subellipticis. On the dead stems of *Heracleum Sphondylium*, Guernsey, Nov., Rev. T. Salwey.

Unilocular, forming little pitch-brown rather convex dots with a paler cloudy narrow border. Mass of spores surrounded by a dark cellular stratum, consisting of hexagonal cells confused with the matrix, but scarcely presenting a definite perithecium. Spores narrow oblong, subelliptic, but by no means filiform.

This species has somewhat the appearance of *Sph. imberbis*, Fr. We have not yet seen the text of the 'Flora Algerensis,' and cannot therefore avail ourselves of the characters of *Phoma* and its allied genera as worked out by Dr. Montagne. Our plant is a good *Phoma* according to Fries' notion of the genus, but has not a sufficiently definite perithecium to justify its being placed in *Sphaeropsis*, which it seems is to receive such fungi as have unilocular spores seated on sporophores and a definite perithecium. It will however probably be found necessary to place certain species with extremely minute spores in *Sphaeronema*, or if the hyaline elongated species alone are to remain in that genus, in *Zythia*, Fr. M. Desmazières has lately proposed as the distinguishing character of *Phoma*, spores with a sporidiolum at either extremity. If this view is rigorously followed, our species must find another habitation. In point of fact the names assigned to these obscure fungi must, till the genera are settled, be considered provisional. We add one or two species, which, with the exception of the first, accord exactly with M. Desmazières' definition.

395. *P. nothum*, n. s. Tectum ; peritheciis spuriis subtus hic illic elevatis ; sporis obovatis. On dead plane twigs, Batheaston, February, C. E. Broome.

Pustules slightly raised. Perithecia spurious, orbicular, the base protruding here and there into their cavity. Spores obovate, rather pointed at the narrow extremity.

This cannot be placed in *Sphaeropsis* on account of its spurious perithecium, which has a tendency to become multilocular, and the spores do not accord with those of *Cytispora* ; for the present therefore we are compelled to place it with the last in *Phoma*.

395*. *P. lingam*, Desm. Exs. no. 1877. On old cabbage-stalks, King's Cliffe.

396. *P. radula*, n. s. Tectum, peritheciis teneris lato-conicis ; sporis oblongo-ellipticis. On dead twigs of plane, Batheaston, C. E. Broome, Feb. 1850.

Sprinkled over the twigs, which it renders rough like a little rasp or grater. Epidermis split on each perithecium. Perithecia delicate, composed of subhexagonal cells ; spores minute, oblong-elliptic, with a sporidiolum at either extremity. Very rarely we

have observed an additional sporidiolum in the centre. A perithecium, though delicate, is decidedly present in this species.

397. *P. depressum*, n. s. Tectum; quandoque pluriloculare peritheciis spuriis valde depressis supra stromate crassiusculo olivaceo tectis; sporis oblongo-ellipticis. On twigs of *Robinia Pseudacacia*, Batheaston, C. E. Broome, Feb. 1850; on elm, King's Cliffe.

Scattered, forming little pustules pierced by the orifice. Perithecia much depressed, spurious, covered by an olive-coloured stroma. Spores minute, oblong-elliptic, rather pointed at either extremity, towards which there is a sporidiolum. Sometimes there is more than a single cell, when the species approaches *Cytispora*. This will probably form the nucleus of a distinct genus.

398. *P. Samarorum*, Desm.; Duby, Bot. Gall. p. 727; Desm. Exs. no. 349. 1875. On Samari of ash, Batheaston, Jan. 1850, C. E. Broome.

Forming conspicuous black spots; cuticle closely applied to the perithecia. Perithecia convex, black, pierced in the centre. Spores minute, oblong-elliptic, with a sporidiolum towards either extremity.

This is more conspicuous than several other species, and resembles *Sphaeria clypeata*. It occurs also on *Ptelea trifoliata*.

399. *P. piceum*, n. s. Hypophyllum; peritheciis spuriis piceis convexis epidermide arcte tectis; sporis oblongo-ellipticis. On the under surface of dead rose-leaves, King's Cliffe, Feb. 1850.

Scattered; pustules conspicuous, convex, pitch-brown; cuticle closely connected with the spurious perithecia; spores pure white, minute, oblong-elliptic, with a sporidiolum at either extremity.

Resembling *Cytispora foliicola* in appearance, but differing greatly in structure. *Ceuthospora concava*, Desm., which has the same place of growth, is much larger.

400. *P. sticticum*, n. s. Minimum; peritheciis epidermide demum longitudinaliter fissa obtectis; sporis oblongo-ellipticis. On dead twigs of box, Batheaston, C. E. Broome, Feb. 1850.

Scattered, very minute, covered by the cuticle, which at length splits lengthwise. Spores oblong-elliptic, with a sporidiolum at either extremity.

400*. *P. exiguum*, Desm. Exs. no. 1869. On shoots of elder, Batheaston, C. E. Broome.

Another small species grows on decorticated twigs with elliptic or nearly globose dark spores, which we purpose calling *P. Sambuci*, but we have scarcely specimens enough to describe it properly.

401. *P. microscopicum*, n. s. Peritheciis subglobosis sub epi-

dermide dealbata supra ostiola nigrefacta sparsis; sporis oblongo-ellipticis. On dead stems of a *Potamogeton*, West of England, C. E. Broome.

Forming scattered very minute dark brown dots on discoloured patches. Beneath each dot is seated a distinct subglobose smooth perithecium, with no visible mycelium, very slightly conical above, pierced with a round simple ostiolum. Spores oblong-elliptic, variable in size, having occasionally but not constantly a sporidiolum at either extremity.

402. *Leptothyrium Juglandis*, Lib. Pl. Crypt. Ard. no. 164. On half-dead walnut-leaves, Bungay, Mr. D. Stock.

403. *Cryptosporium Caricis*, Corda in St. Deutsch. Fl. t. 50. On leaves of different *Carices*, Oxton, Notts, Rev. M. J. Berkeley; Spye Park, Wilts, C. E. Broome.

The specimens given for this species by Rabenhorst, no. 1168, are *Arthrimum Caricola*. Such errors are unfortunately too frequent in his published specimens.

404. *C. Neesii*, Cord. St. Deutsch. Fl. t. 51. On dead twigs of birch, King's Cliffe; West of England, C. E. Broome.

This is scarcely congeneric with the foregoing, though placed in the same genus by Fries, who names it *C. vulgare*.

405. *Sphæronema leucoconium*, n. s. Gregarium; peridiis hyalinis plano-convexis depressis subirregularibus floccis niveis insidentibus. On decaying roots of Silesian beet, King's Cliffe, Nov. 1847.

Forming a thin stratum consisting of minute depressed sub-hemispherical or irregular white perithecia simply pierced with a minute pore, and seated on branched white threads, of which a few spring from the sides. Spores minute, elliptic.

We are unable to point out any closely allied species. There is no papillæform or elongated ostiolum, but the convex perithecium is merely pierced in the centre.

406. *Diplodia Cowdellii*, n. s. Peritheciis liberis globosis atris apice demum dehiscens; sporis minoribus ellipticis uniseptatis. On the thick cotton curtains of a shower-bath which were constantly damp. Oundle, Norths. Pointed out by Dr. Cowdell, the author of the treatise on the Fungous Origin of Cholera.

Forming dirty black spots on the matrix, but without any evident floccose stratum. Perithecia globose, at length cracking above, black. Spores minute, elliptic, uniseptate.

An obscure species, but remarkable for its singular habitat and free mode of growth.

406*. *D. paupercula*, n. s. Peritheciis primum tectis demum liberatis globosis ore prominulis; sporis minoribus sero uniseptatis. On dead twigs of plane, Batheaston, C. E. Broome.

Resembling *Phoma nothum* and *P. radula*. Perithecia one or two together, at first concealed, at length exposed, globose, with a rather prominent orifice. Spores small, at first hyaline, elliptic or obovate, and falling off in that state, at length oblong, brownish and uniseptate. The infant perithecia are filled with a compact white cellular mass, as in many *Sphæriæ* when young, and perhaps all. Spores at first resembling those of *Phoma nothum*, which is distinguished from every state of this species by its spurious, imperfect, somewhat irregular perithecia.

407. *D. mutila*, Fr. in litt. Common on dead twigs of poplar.

408. *D. confluens*, n. s. Peritheciis confluentibus maculas parvas efformantibus depressis subcollapsis ostiolo obsoleto. *D. mutila*, Desm. no. 1880. On twigs of *Daphne Laureola*, Milton, Norths., Mr. J. Henderson, July 1840.

Forming small, often confluent spots surrounded by the free raised cuticle. Perithecia irregular, confluent, depressed, somewhat collapsed, with no evident ostiolum. Spores oblong, simple in our specimens, but probably immature.

This species has exactly the appearance of some *Sphæriæ* of the section *Confluentes*, and forms far larger patches than in *D. mutila*, of which it is considered a form by M. Desmazières.

409. *D. cæspitosa*, n. s. Cæspitosa nigra; peritheciis globosis ostiolo papillæformi; sporis oblongis. On twigs of ivy, King's Cliffe.

Bursting in little black tufts through the cuticle. Perithecia globose, black; ostiolum papillæform. Spores pale yellow, hyaline, oblong, with a broad distinct border; endochrome simple, without any distinct nuclei; the spores however are doubtless immature.

A well-marked species, resembling externally some cæspitose *Sphæriæ*. The spores in this as in the last exhibit no trace of a dissepiment, but we do not doubt that when mature they present in both the common type of *Diplodia*. It differs from *D. mutila* in its cæspitose habit.

410. *D. vulgaris*, Lév. in Ann. d. Sc. Nat. May 1846, p. 291. On twigs of various trees, as at Rudloe, Wilts.

411. *D. tecta*, n. s. Peritheciis tectis gregariis epidermidem elevantibus, ostiolo cuticula denigrata polita velato; sporis majoribus oblongis. On dead leaves of *Prunus Lauro-Cerasus*: very common.

The leaves are rough with little elevated pustules disposed often in dry discoloured patches marked in the centre with a shining black speck. Spores oblong; endochrome simple as observed at present.

This is technically a *Sphæropsis*, but as every *Diplodia* is a

Sphaeropsis at an early stage of growth, it requires some caution in assigning the genus where the spores present the usual type of the young spores of *Diplodia*.

412. *D. consors*, n. s. Peritheciis gregariis tectis; epidermide polita nigrefacta centro dehiscente albida; sporis minoribus oblongis. Growing on the same leaves with *D. tecta*, but generally in distinct patches and equally common.

Forming broad patches. Perithecia covered, indicated by small shining black dots which open in the centre by an irregular orifice, the edges of which are white. Spores only two-thirds of the length of those of *D. tecta*, oblong-elliptic, uniseptate.

The two species are extremely common, but we cannot find any notice of them.

413. *Hendersonia macrospora*, n. s. Peritheciis omnino tectis; sporis rectis anguste lanceolatis 5-8-septatis. On dead twigs of *Philadelphus coronarius*, Apethorpe, Oct. 1848.

Entirely concealed by the cuticle, which is very slightly raised. Perithecia globose. Spores narrowly lanceolate, 5-6-septate.

Distinguished by its concealed habit and long fusiform spores.

413*. *H. arcus*, n. s. Peritheciis denudatis globosis, sub microscopio chalybeis; sporis arcuatis medio incrassatis 3-septatis. On box twigs, Batheaston, C. E. Broome.

Perithecia globose, at length naked, subgregarious, black, but when seen by transmitted light steel-blue. Sporophores branched; spores elongated, curved, swollen in the centre, attenuated at either extremity, hyaline, triseptate.

Resembling closely in form and colour *Sphaeria pulicaris*, with which it often grows. The fructification is however totally different, and can scarcely be a transformation of the asci of that species.

414. *H. mutabilis*, n. s. Pustulis depresso-ellipticis intus cellulosus sporis oblongo-ellipticis 3-4-septatis articularis hic illic longitudinaliter divisus. On dead twigs of plane, Batheaston, C. E. Broome.

Pustules small, scarcely bursting the cuticle, elliptic, black, with a few central cells besides the large cell or perithecium, which occupies the whole of the pustule. The central cells are developed later than the main cell, so that the spores in the former are simple or uniseptate, while in the larger cell they have acquired a much larger size, and have three or four transverse septa with the articulations here and there divided.

A section with the central cells and the large one surrounding them filled with spores in different stages of development presents a very curious appearance under the microscope.

415. *H. polycystis*, n. s. Pustulis sub epidermide lanatis intus multilocularibus; sporis maximis cum pedicellis septatis clavatis, demum deciduis effusis oblongo-ellipticis multilocularibus. On dead twigs of birch, Batheaston, C. E. Broome.

Pustules depressed, elevating the cuticle slightly, beneath which they are densely clothed with white or cinereous flocci; perithecia globose; spores large, supported on septate peduncles, at first taken with the peduncles, clavate, at length deciduous, oblong-elliptic, multilocular, oozing out and forming an irregular black mass, clothed till mature with a pellucid gelatinous annulated envelope.

416. *H. macropus*, n. s. Peritheciis depressis subcollapsis; sporis pedicellatis, elongatis cylindricis curvulis sporidiolis 3-6 repletis. On dead leaves, probably of some *Carex*, Spye Park, Wilts, Jan. 1850.

Perithecia depressed, somewhat collapsed, entirely covered and pouring out their spores by a minute orifice, so as to make little black stains on the leaves. Spores furnished with a long peduncle, cylindrical, but slightly attenuated at either end, many times longer than their diameter, somewhat curved, containing 3-6 sporidiola.

417. *H. typhoidearum*, Desm. Ann. d. Sc. Nat. June 1849, p. 344; Exs. no. 1891. On leaves of *Typha* and *Sparganium ramosum*, Spye Park, Wilts, C. E. Broome, Feb. 1850.

The spores of this species as of the foregoing, *H. uredineicola* and some others, are not distinctly septate, but contain a row of sporidiola. In separating *Hendersonia* from *Sphaeropsis*, care must be taken not to confound mere oil-globules with sporidiola. Species like the present, in fact, forming M. Desmazières' second section, will, in all probability, at some future period be considered generically distinct. Our specimens are somewhat larger than M. Desmazières', but otherwise accord with them.

418. *Sphaeropsis cylindrospora*, Desm. Ann. d. Sc. Nat. May 1849, p. 277. *Diplodia Desmazierii*, Berk. in Gardiner's Fl. of Forfars. p. 298. On both surfaces and on the petioles of ivy-leaves, West Water, Forfarshire, Mr. W. Gardiner; Aberystwyth, J. Ralfs, Esq.

Remarkable for the linear straight spores exceeding their diameter in length 6-7 times. The spots are far smaller than in mature specimens of *S. leucostigma*.

419. *S. Ralfsii*, n. s. Peritheciis sparsis tectis punctiformibus fortiter collapsis; sporis minutissimis oblongis. On ivy-leaves, Aberystwyth, J. Ralfs, Esq., with the foregoing, which was however confined to the petioles.

Scattered over the upper surface of the leaf, punctiform, black,

strongly collapsed, and presenting the appearance of accurately defined excipula. Spores oozing out on the application of moisture from a central pore, extremely minute, oblong.

420. *S. leucostigma*, Lév. Ann. d. Sc. Nat. May 1846, p. 296. *Sphaeria Hederae*, Sow., and partly of Fries. Not uncommon on dead ivy-leaves, England and Wales.

420*. *S. parca*, n. s. Peritheciis minutis tectis collapsis; sporis oblongis diametro 4-5 longioribus. On leaves of *Abies excelsa*, Wiltshire, C. E. Broome, Jan. 1850.

Scattered sparingly on the leaves. Perithecia collapsed when dry, so as not to rise at all above the surface, black. Spores oblong, subcylindrical, obtuse at either end, but often suddenly attenuated at one extremity, 4-5 times longer than their diameter.

Resembling very much *Sph. Buxi*, DeC., which is also a *Sphaeropsis*, but differing in its collapsed perithecia and narrower spores.

421. *S. Strobi*, n. s. Peritheciis minutis tectis collapsis; sporis linearibus diametro 6-7 longioribus. On leaves of *Pinus Strobus*, Wilts, C. E. Broome, March 1850.

Very like *S. parca*, but scarcely so much collapsed. It differs in the longer narrower spores, which are never attenuated suddenly.

421*. *S. geniculata*, n. s. Peritheciis globosis tectis, ostiolo conico prominente; sporis curvis æqualibus obtusis diametro 4-5 longioribus angulo obtuso affixis. With the last on leaves of *Pinus Strobus*, C. E. Broome.

Perithecia globose, covered by the epidermis, which they pierce by means of their prominent conical ostiola. Spores cylindrical, curved, obtuse at either end, fixed at an obtuse angle obliquely to long delicate sporophores; sometimes there is a nucleus at either extremity.

422. *S. epitricha*, n. s. Peritheciis globosis omnino tectis mycelio furcato-ramoso parco insidentibus; sporis oblongis diametro triplo longioribus. On dead stems of *Equisetum palustre*, Wiltshire, C. E. Broome.

Perithecia globose, seated beneath a discoloured cinereous spot springing from forked septate threads. Spores oblong, about three times longer than their diameter.

We have unfortunately no specimen of *Sphaeria Equiseti*, Desm.; but from the author's remark that it is scarcely different from his *Phoma albicans*, it cannot be the same thing with what we have in view. *Phoma Equiseti*, Lév., is also unknown to us, but the description is at variance with our plant, which could scarcely be placed in *Phoma*. The forked septate threads of the mycelium with their obtuse apices are very remarkable. It is probably very common.

422*. *S. mutica*, n. s. Erumpens, peritheciis globosis obtusis subcæspitosis ; sporis minimis ellipticis vel obovatis hyalinis. On small branches of elder, Bathcaston, C. E. Broome.

Erumpent. Perithecia more or less cæspitose, globose, blunt, black, shining. Spores very small, hyaline, elliptic or obovate.

This has exactly the habit of a *Diplodia*.

423. *S. Candollii* = *Sphæria Buxi*, DeC. Fl. Fr. vol. vi. p. 146 ; Berk. Fung. n. 180, quoad specimina provecetiora. *Septoria Phacidioides*, Desm. no. 1719.

The spores in this species are hyaline, oblong, about twice as long as broad, varying from elliptic to obovate.

424. *S. thecicola*, n. s. Superficialis convexa collabescendo rugosa ; sporis tenuissimis linearibus rectis. On thecæ of *Polytrichum piliferum*, Aberdeen, Dr. Dickie.

Perithecia black, scattered, convex, at length collapsing, opening by a definite orifice. Spores very slender, hyaline, linear, straight, of various lengths.

The spores in this species are longer and more slender than in *S. cylindrospora*, and resemble those of such *Septoriæ* as *S. Lepidii*. *Sphæria emperigonia*, Auerswald in Rab. no. 850, which grows on a *Polytrichum*, has asci with subcymbiform uniseptate spores, and is therefore a true *Sphæria*.

425. *S. menispora*, n. s. Teeta ellipsoidea nigra poro rotundo demum pertusa ; sporis arcuatis longis ; nucleis globosis hic illic sparsis. On dead leaves of *Typha latifolia*, Spye Park, Wilts, C. E. Broome.

Entirely concealed beneath the cuticle, with the exception of the round ostiolum. Perithecia ellipsoidal, black. Spores very long, curved, acute at either end, containing many scattered globose pellucid nuclei.

The nuclei are not arranged regularly in a single row, and therefore probably do not represent endochromes.

DISCELLA, n. g.

Perithecium spurium subsimplex supra quandoque obsoletum vel omnino deficiens indeque excipuliforme ; sporis elongatis simplicibus vel uniseptatis sporophoris suffultis.

The perithecium in this genus is so little distinct from the stratum of sporophores, that it is frequently difficult in examining a slice under the microscope to say that it really exists, though the two together are sometimes of considerable thickness ; neither, on the other hand, is the limit between the external cells and those of the matrix very accurately defined. In the same species it is sometimes entirely wanting above, and the sporophorous stratum merely covered by the cuticle, which at last splits and exposes the excipuliform disc, while in other cases the spurious

perithecium extends all round, being intimately blended with the cuticular cells. The cavity is essentially simple, but there is sometimes a slight fold or two below, showing a tendency to become multicellular; occasionally the centre is vacant, and the perithecium then forms an irregular ring. The species would probably be comprised by Corda in his *Næmaspora*, which however comprehends more than one distinct form. *Sporonema*, Desm., seems to be the nearest ally of this genus.

426. *D. carbonacea*. Perithecio nigro; sporis elongatis subfusiformibus sub lente prasinis uniseptatis. *Phacidium carbonaceum*, Fr. ! *Sci. Suec.* no. 210; *Berk. Br. Fung. ed. 1.* no. 44 in part. *Stilbospora microsperma*, Johnst. ! *Fl. Berw.* vol. ii. p. 192. Common on dead shoots of willows. We have this species from Paris, communicated by Messrs. Tulasne.

Forming small scattered disc-like spots covered with the cuticle, which splits from the centre and ultimately separates. Perithecia black, generally excipuliform, but sometimes extending all round, and then bursting above with the cuticle. Spores oblong, subfusiform, pale yellow-green when seen by transmitted light, uniseptate.

M. Desmazières has more than once called our attention to the structure of this species, a structure which we had recognized soon after its publication in the 'British Fungi,' and of which we had previously made an analysis in the following interesting species, with which we have been acquainted many years. We should have preferred leaving the matter in his hands, but as he has not yet published the genus, and we do not like to omit the following very singular production, we feel sure that he will pardon us in trespassing for a moment on his manor. It is to be observed that two things appear under no. 44 cited above, the present species, and one with much smaller spores which we have named *D. microsperma*. *Pilidium carbonaceum*, Libert, which has been supposed to be the real plant of Fries, is the same with *Cenangium fuliginosum*, Fr. It is not however ascophorous.

PLATE XII. fig. 8. *d.* Spores magnified 340 diameters.

427. *D. Desmazierii*, n. s. Perithecio molli externe hyalino intus cyaneo; sporophoris elongatis; sporis fusiformibus simplicibus cyaneis. On twigs of lime, Northamptonshire.

Forming like the last scattered discs, which however are blacker from the spores being darker. Perithecium delicate, hyaline next to the matrix, then blue, obsolete above. Sporophores elongated, strongly developed, sometimes forked. Spores of a beautiful indigo-blue, truly fusiform, though not much elongated, without any septum as far as we have observed, distinctly bordered; larger than in *D. carbonacea*.

The perithecium is but slightly compacted in this species, and the part nearest to the cortex is hyaline. The colour of the spores is deep sea-blue, exactly the *vitreus* of the Latins.

PLATE XII. fig. 8. *a*. Section of perithecium magnified; *b, c*. spores and sporophores magnified 340 diameters.

428. *D. platyspora*, n. s. Peritheciis minoribus supra pro maxima parte deficientibus; sporophoris validis cum sporis oblongis amplis utrinque obtusis sæpe deciduis. On dead twigs of plane, Batheaston, Feb. 1850.

Forming rather minute slightly raised pustules; perithecia but slightly developed, generally if not always deficient above. Sporophores short, stout, obtuse, simple, often breaking off with the oblong obtuse spores, the cavity of which is simple, but the contents decidedly granular, so as at first to give a granulated aspect to the outer wall.

429. *D. microsperma*, n. s. Perithecio nigro sub lente pallido; sporis minoribus oblongis simplicibus. On dead twigs of willows, King's Cliffe, and in the West of England, C. E. Broome.

Resembling strongly *D. carbonacea*, but somewhat larger, and distinguished at once by the minute oblong simple spores several times smaller than in that species. In some pustules of this species we have seen the perithecia open by a minute fissure, the lips of which being elongated by the oozing out of the spores make a spurious ostiolum.

It is given in the first edition of 'British Fungi' with *D. carbonacea*, at no. 44, as a state of *Phacidium carbonaceum*, Fr.

PLATE XII. fig. 8. *e*. Spores magnified 340 diameters.

429*. *D. abnormis*, n. s. Perithecio globoso spurio prorsus tecto poro pertuso; sporis breviter fusiformibus luteo-fuscis uniseptatis. On shoots of elder, Batheaston, C. E. Broome.

Perithecia small, entirely covered with the cuticle, globose, confused with the matrix, pierced above with a round pore. Spores shortly fusiform or lanceolate, uniseptate, yellow-brown.

This species approaches the type of *Diplodia*. It is mixed with a *Phoma*, no. 406*, which is more conspicuous, though smaller.

430. *Vermicularia atramentaria*, n. s. Effusa gregaria maculæformis; sporis rectis brevibus endochromate utrinque retracto. On decayed stems of potatoes: extremely common.

Forming large ink-black velvety patches, crowded with minute perithecia clothed with long straight subulate bristles, connected at the base by intricate fibres creeping beneath the cuticle of the matrix. Spores minute, linear, rather short; endochrome retracted to either extremity.

Distinguished at once by its straight spores. In general ap-

pearance it resembles somewhat *Sphaeria Dematium*, Fr., which is also a *Vermicularia* (*V. Dematium*, Fr.), but in that species the spores are longer and curved.

431. *Septoria Lepidii*, Desm. Exs. no. 1177. On *Lepidium Smithii*, Penzance; Aberystwyth, J. Ralfs, Esq.

432. *S. Aceris*, Berk. & Br. *Ascoxyta Aceris*, Lib. Ard. no. 54. On the under side of the leaves of *Acer Pseudo-Platanus*, North Wales, J. Ralfs, Esq.

The spores in this species form little pallid cirrhi. In Mr. Ralfs's specimens these are in general shorter than Madame Libert's, but there is no other difference. The spores are very distinctly septate, especially in the Welsh specimens.

433. *S. nodorum*, Berk. Maculis pallide cervinis limitatis depressis demum confluentibus, peritheciis subprominulis; sporis oblongis elongatis curvulis libet irregularibus. Berk. in Gard. Chron. 1845, p. 601. On the joints of wheat-stalks just before the wheat is ripe. Spores elongated, very slightly curved or irregular, with several nuclei.

434. *S. Hippocastani*, n. s. Maculis rufis, cirrhis teneris; sporis curvis flexuosis linearibus simplicibus. On leaves of the horse-chestnut, Essex, Rev. J. E. Leefe.

Spots at first minute and scattered, then becoming confluent, and forming broad rufous patches. Cirrhi delicate, pale. Spores long, linear, simple, curved, flexuous.

This species belongs evidently to a different genus from *Ascoxyta Hippocastana*, Libert.

435. *Neottiospora Caricum*, Desm. Exs. no. 1338. *Sphaeria Caricina*, Desm. Exs. no. 717. On dead leaves of Carices, Rudloe, Spye Park, Wilts, C. E. Broome.

A most interesting production, remarkable for the appendage of short hyaline threads with which the spores are furnished at one extremity. A variety occurs with larger olive-coloured spores, which we should at once have considered distinct, but for specimens in which the spores, though olive-coloured, without any orange tinge, are exactly of the same size as in the original form. We do not therefore venture at present to consider the two as distinct, though we think it probable that further observations may justify their separation.

436. *Cytispora Hendersoni*, n. s. Perithecio subregulari; gelatina albidâ; sporis majoribus oblongis brevibus leviter curvatis. On *Rosa arvensis*, Milton, Mr. Henderson.

Forming minute scattered pustules; perithecia nearly regular, but sometimes lobed at the edge and raised in the centre from the elevation of the subjacent bark. Spores larger than in most *Cytisporæ*, oblong but short, very slightly curved, oozing forth in the form of a dirty-white shapeless jelly.

This species is exactly intermediate between *Cytispora* and *Sphaeropsis*, scarcely agreeing with either genus; resembling the former in its delicate perithecium and oozing spores, and the latter in its simple cavity and spores. In both these points however an approach is made to *Cytispora*, therefore the predominance of characters points to this rather than the other. *Nemaspora grisea*, Corda, is we believe a young *Diplodia*.

437. *Micropera Drupacearum*, Lév. Ann. des Sc. Nat. May 1846, p. 283. On dead branches of cherry, King's Cliffe.

Centhospora Phacidiodides, b. Desm. no. 1626 = *Cytispora foliicola*, Lib. no. 64 = *Cyt. pulveracea*, Berk. Br. Fl. vol. v. P. 2. p. 282.

[To be continued.]

XXXIV.—On the species of *Cercolabes* confounded under the name of *C. prehensilis*. By J. E. GRAY, Esq., F.R.S., Pres. Bot. Soc. &c.

MR. WATERHOUSE in his 'History of Mammalia' observes, that *C. prehensilis* "is frequently met with in Brazil and Guiana, and it occurs likewise in Santa Cruz de la Sierra, a district of Bolivia, in which nearly all the mammalia are identical in species with those of Brazil," ii. 411. Further on he proceeds to describe a specimen in the British Museum brought from Bolivia by Mr. Bridges.

When Mr. Waterhouse made these observations the specimen was not stuffed, and he could not examine the skull; since that period the skull has been removed, and I think its examination proves that the Bolivian species is perfectly distinct from those which are received from Brazil.

It may be thus defined:—

1. *Cercolabes prehensilis*. Brazilian Coendou.

Black and white varied. Quills white, with a broad subterminal reddish brown (or black) band; under part of the body and upper part of the base of the tail whitish, under part of the base and end of the tail dark brown; whiskers slender, black to the base; upper cutting-teeth smooth in front.

Young. Fur reddish with a few scattered spines.

Hab. Brazils, adult and young.

Var. ? On spines and under part and end of tail black.

Half-grown ?

Hab. Spanish Main.

2. *Cercolabes Boliviensis*. Bolivian Coendou.

White, slightly black varied. Quills white, with a rather nar-

row subterminal black-brown band ; tail and underside of body white, scarcely black varied ; whiskers thick, black, white at the base ; upper cutting-teeth with a distinct subcentral longitudinal groove.

Young. Fur ——— ?

Cercolabes prehensilis, var. Waterhouse, N. H. Mamm. ii. 414.

The skull of the Bolivian specimen is much larger, wider over the orbits and much higher from the palate to the nose and forehead than in the Brazilian specimens : the grinders are considerably smaller, and it has the peculiar groove on the upper grinders, but the latter may be an accidental or individual peculiarity.

The following measurements in inches and lines of three skulls in the Museum collection will show these peculiarities. No. 1 is the skull of the Bolivian specimen ; No. 2 that of the Brazilian specimen : these animals are nearly of the same size. No. 3 is a skull of a skeleton from the Brazils.

	No. 1.		No. 2.		No. 3.	
	in.	lin.	in.	lin.	in.	lin.
Skull : Length, entire	4	2	3	5	3	7½
Width at orbit	2	4	2	2	2	3
—— over orbit	2	4	1	6½	1	8½
—— at nose	1	1½	1	1	0	11½
Height from palate to tip of nose ...	1	5	1	1½	1	2
—— from palate to top of forehead .	2	2	1	9½	1	10
—— of teeth series	0	9½	0	9½	0	10

There is a specimen in the Museum which Mr. Waterhouse has described as a variety (Hist. Mamm. ii. 415). It is very distinct in appearance from either of the above, but best agrees with the specimen from the Brazils in the blackness and slenderness of the whiskers and the smoothness of the upper cutting-teeth, and the blackness of the tip of the tail, but differs in the general colours being much blacker, and in the underside of the body and tail being nearly black and only very slightly grizzled, and especially in the tips of some of the spines on the sides being yellow. I strongly suspect it will prove a third species, to which the name of *C. tricolor* might be attached.

XXXV.—On the characteristic Fossils of the Chalk Formation.

By L. VON BUCH*. Communicated by Prof. J. NICOL.

THROUGHOUT all the members of the chalk formation, three chief forms of organic beings seem especially adapted to serve as characteristic fossils. These are the *Ammonidæ*, the *Trigoniæ*, and

* From Betrachtungen über die Verbreitung und die Grenzen der Kreide-Bildungen. Bonn, 1849.

the *Exogyra*. A few words explaining the general character of these forms may not prove unacceptable.

1. THE AMMONIDÆ.

It is well known, that the Ammonites, still so remarkably abundant in the lowest cretaceous beds, or the Néocomien, rapidly decrease in the higher strata; so much so, that even in the upper chalk they no longer occur, and that every trace of them has since vanished from the surface of the earth. There is however something very remarkable in the manner of this disappearance. The greater number of the Ammonites seem to suffer from the disease which at length expels them from creation. The whorls in many no longer lie exactly in one plane, but the one side projects somewhat forwards and draws the other after it. Soon after they even lose the power to attach themselves closely to the previous whorl; and these are now unconnected (F. A. Römer, Kreide, p. 135), when the *Crioceras*, which is only found in the chalk, is formed. The formation of such unattached whorls soon exceeds the power of the animal to bend its body, and thus to contract itself into such protecting limits,—it is compelled to extend itself lengthwise, and the singular forms of the *Toxoceras*, the *Ancyloceras*, the *Ptychoceras*, finally those of the *Hamites*, and of the *Baculites*, straight like a staff and directed perpendicularly upwards, are produced, and are the last attempts of the animal to maintain its existence. Subsequently nothing appears in nature which can remind us of this kind of Cephalopod. All these forms therefore, diverging from the perfect Ammonite, mark in the most decided manner one or other portion of the cretaceous formation,—they are *leading forms*, which, where they occur, exclude the supposition of any other formation.

It is truly remarkable, that in the same manner as the *Ammonidæ* vanish from the world, in the same manner exactly do the *Nautilidæ* make their appearance in the oldest strata. The entirely straight *Orthoceratites* are the most ancient of all known Cephalopods; they endeavour, at least when young, to attach themselves to the previous whorl, an attempt which, however, must be given up in its further growth, when the animal can only increase lengthwise;—the *Lituite* is produced;—the *Clymenia* succeed in attaching themselves throughout to the previous whorl, in a continuous spiral entirely situated in one plane; the *Nautilus* finally—of which a weak remnant, the *Nautilus pompilius*, has continued to the present time—surrounds all the previous whorls with the last one, and thus withdraws itself more perfectly from the attacks of its enemies. The Ammonite vanishes through a series of forms intermediate between it and the

outstretched Baculite ; the Nautilus on the other hand arises through a similar series of forms from the long-extended Orthoceratites.

Very many Ammonites of the chalk possess another peculiarity by which they are easily recognized, and consequently also the formation in which they are found. The plications (*Falten*) or ribs on the sides become always stronger and thicker the nearer they approach the back ; in the Jura Ammonites they become weaker from below upwards ; on the margin of the back itself they are often so much expanded (*aufgebläht*) that they do not pass over the back and cannot unite with each other from the two sides. The siphon then remains (*bleibt zurück*) in a deep furrow. The secondary plications (*Hülfstrippen*) are of equal strength with the chief plications, especially on the margin of the back, but they disappear even on the middle of the side and rarely unite with the chief plications. This gives the whole form an unhandsome, almost clumsy aspect, which distinguishes it very much from the handsome Jura Ammonites. Instances may be taken from very different families : *Am. Syriacus*, *interruptus*, *Rhotomagensis*, *denarius*, *varicosus*, Sow. &c. This formation evidently arises from the endeavour of the upper half of the animal to move quicker forwards on the back than the lower ventral portion can follow. It is just this endeavour also that produces the singular form of the Scaphites. On more close investigation it would evidently be pronounced a disease of the Ammonite, were not the form too constant, and did it not show too complete an agreement in widely distant regions. It is universally seen in all Scaphites, that they only then first forsake the regular form of an Ammonite when the last septum is formed. The shell suddenly expands immoderately, the former law of the increase of the whorls is entirely suppressed, the lateral ribs and prominences are disproportionately separated from each other, new ribs run down from the back and push themselves strongly forwards. The ventral side separates itself entirely from the whorl, and the shell grows in a straight, no longer spiral direction ; yet not long ; the expanded portion again contracts, the last chamber appears as if drawn together, it anew curves round towards the centre, but by this contraction the life of the animal is soon terminated. If it is a disease of the Ammonites, then it is a real epidemic which has attacked the Ammonites in the cretaceous period, for the Scaphites are far from rare, of very various forms, and almost peculiar to the middle cretaceous strata ; hence they must be especially regarded as characteristic fossils for the cretaceous formations. And these deposits even on the Missouri are no less marked by them than by the large Inocerami. For one of the most beautiful Scaphites, the *S. Nicolletii*, which

has not yet been figured, was brought from the Black Hills in lat. 46° *, by F. Römer.

2. THE TRIGONIAE.

Not only by their numbers, but still more by the richness of their specific divisions, by the peculiar prominence of individualization, do the species of the remarkable genus *Trigonia* attain their maximum point in the lower chalk. They do not long maintain themselves at this elevation; like so many other races they quickly decline again, and the only species of *Trigonia* still living, in the warm waters of the Pacific near the Fidji islands, is but a very miserable remnant of the fine forms which are still preserved in the rocky strata. From this multiplicity of forms many might easily be selected as fully characteristic of the chalk; these would however be isolated, and found not universally, but perhaps only in a few localities. On the contrary, that remarkable family of *Trigoniae*, which Agassiz has named '*Trigoniae scabræ*,' is dispersed over every land where the chalk occurs, and such a *Trigonia* is alone sufficient to determine the age of the formation in which it occurs. The peculiar and prominent characteristic of these forms is a remarkably produced ventral margin, when the area of the posterior side is brought, as usually happens, into a concave position. This is produced by the very oblique angle at which the posterior and anterior sides meet at the hinge, an angle which seldom exceeds 60° , whereas in other families these two sides meet at a right angle. Along with this all the *Scabræ* appear much intumescend at the hinge, and fall quickly off with some degree of acuteness before attaining the posterior termination. The sides are adorned with ribs, running down perpendicularly, of which only a few curve round below the hinge and become united on the anterior surface. These ribs are divided, crenulated, by more or less acute divisions, placed close together, and they are also sometimes slightly curved towards the posterior area, when the side of the shell declines somewhat more quickly backwards. From such minute distinctions Agassiz and D'Orbigny have formed many distinct species, *Trigonia scabra*, *aliformis*, *carinata* and others. However, the characters on which these various species have been founded have no fixed limits, but pass insensibly into each other; the numerous crenulations of the *Trigonia carinata* are easily lost on the *Tr. scabra* and *aliformis*; the depression of the posterior part of *Tr. aliformis* is very often altogether wanting. On the other hand, the number of the ribs, with nearly equal size, continues almost constant. Eighteen to twenty ribs are almost invariably counted on the sides of these *Tri-*

* A description of this new species is then given by the author.—
TRANS.

gonia, of about $2\frac{1}{2}$ inches in size, as well in France as in England and America. This is also the case with the Mexican *Trigonia*, described (Bulletin de Bruxelles, tom. vii. no. 10) by MM. Nyst and Galeotti, which they have named *Tr. plicato-costata*. It is not distinct from the *Trigonia crenulata* of Lamarck and Agassiz, and when of the same size has the same number of ribs on the side. When thus limited and again referred to the oldest name proposed by Sowerby of *Trigonia aliformis*, this remarkable *Trigonia* is dispersed over the whole extent of America, and everywhere characterizes the middle chalk. Even the *Trigonia thoracica* described by Morton from Alabama is now recognized by him as *Trigonia aliformis*. M. Galeotti relates that the *Trigonia* discovered and published by him occurs in the marls of a very extensive limestone formation in the middle of the great and principal Cordillera of Anahuac, twelve French miles W.N.W. from the town of Tehuacan in the district of Puebla, and four to seven thousand feet above the sea level. In that place it is so abundant and large that it may be considered the chief and most characteristic fossil of the whole formation. It is wonderful, says Galeotti, to find in one place such vast accumulations of fossil shells, fragments of so many Ammonites several feet in diameter, or of gigantic stems of corals; so much so, that perhaps there is no other locality on the whole surface of the earth, where over several square miles such an immense mass of organic remains are dispersed. Some Ammonites are figured by Galeotti and described by Nyst, but neither the description nor the figure gives a clear view of the whole; they remind us chiefly of the *Ammonites Carderoni* of D'Orbigny. This same *Trigonia* again appears in South America, in the mountains of S. Fé de Bogota, whence they were first brought to us by Von Humboldt (Pétréf. recueillies en Amérique, p. 8. f. 10). It occurs here dispersed over a wide space, from Socorro on the north to Tocaymo on the south of Santa Fé. It also shows the same depression of the lower border, the same acute angle, scarcely exceeding 60° , of the anterior and posterior margin, the same number of perpendicular plications on the sides, and the same crenulations on the plications. It seems therefore without sufficient foundation that some naturalists believe this *Trigonia* to be a new species. D'Orbigny has quoted it with some doubt as *Trigonia subcrenulata**, and Lea under the name of *Trigonia Tocaymana*†. Since now the mountains of Santa Fé are proved most distinctly by the organic remains inclosed in the strata to belong to the middle cretaceous series, as I have endeavoured to prove in the description of Humboldt and

* Coquilles de Colombie par M. Boussingault: Paris, 1842, p. 52. pl. 4. f. 7-9.

† Trans. Amer. Phil. Soc. 2nd ser. vol. vii. p. 6. pl. 9. f. 8.

Ann. & Mag. N. Hist. Ser. 2. Vol. v.

Degenhardt's 'American Fossils' (Berlin, 1839), and as still more clearly appears from Alcide D'Orbigny's learned work on Bous-singault's collections, it follows that the strata discovered by Galeotti above Tehuacan must be joined, with all their organic remains, to the middle chalk. The collections made by Burkart, Councillor of Mines in Bonn, in the mountains of Guanaxuato, contain nothing opposed to this view. We do not again find this *Trigonia* further south in America, in Peru or in Chili, at least it has not yet been observed in the cretaceous strata so common in all this region. On the other hand it appears in other quarters of the globe. The enterprising and talented Director Kraus of Stuttgart has brought from Zwartkopp, Algoa Bay at the Cape of Good Hope, a *Trigonia* which in all essential characters agrees with the *Trigonia aliformis*—even the acute angle, under 60°, of the anterior and posterior margins, and the direction of the ribs with the fine crenulations on them. Herr Kraus has named this shell *Trigonia ventricosa*. It is almost surprising to find this same *Trigonia aliformis* in the chalk hills which appear as if blown by the winds over the vast peninsula of Hindostan, quite in the south, near the point at Verdachellum to the south-west of Pondichery, and nearly in the same circumstances as in Europe and America. Prof. Edward Forbes, the most distinguished palæontologist in England, affirms that he could find no distinction whatever between the Indian *Trigoniæ* and those from Black-down*. Along with it *Cardium Hillanum*, *Pecten quinquecostatus*, *orbicularis*, *obliquus*, occur, so that Mr. Forbes has no difficulty in referring the strata of the hill of Verdachellum to the upper greensand and the gault, or exactly the place to which the thick beds of St. Fé de Bogota, of Tehuacan and of Alabama, must be referred. Still the Indian beds contain a great number of forms which are peculiar to them alone, and perhaps bear some relation to tropical conditions of climate, and which by themselves might be a reason for suspecting that these hills form a very highly developed tertiary formation. The *Trigonia* alone is sufficient to lead us to a better conclusion. It is a *characteristic fossil*.

3. THE EXOGYRÆ.

Still more even than the *Trigoniæ*, we may regard the *Exogyræ* as a stamp impressed on the whole cretaceous formation. These singular oysters appear for the first time in the Jura deposits, but only small, hardly an inch in size, and in most cases (*Exogyra virgula*, *Knorrii*, *spiralis*, *auriformis*) scarcely larger than beans. Wherever they are several inches in size, it may be unconditionally assumed that they declare the formation to be cre-

* Geol. Trans. 2nd ser. vol. vii. P. iii. p. 151. pl. 14. f. 3.

taceous. They then exhibit great diversity of form, but are at the same time so remarkably regular in their geological position, that each of the four divisions of the chalk may be distinguished by certain forms of *Exogyra*; and hence they are of the greatest importance for determining to which of these divisions of the chalk a particular bed belongs. The beak of all the *Exogyra* is very much twisted, sometimes turned round two or three times like a ram's horn. This twisting is always found on the right side of the deeper (lower) valve, when the hinge or beak is turned towards the observer. On this side of the beak also there always appears a more or less distinct, narrower or broader depression, which is continued from the margin to the beak. In the interior of the shell this depression forms a swelling on which the muscular impression is seen. Hence it is evidently the muscle that pulls up the mantle and along with it also the shell which it produces, and thus causes the furrow or depression on the exterior surface. This is a chief character of all the *Exogyra*, which is wanting in the *Gryphææ* and still more in the oysters. This also explains why the right side of the *Exogyra* is always the smaller one, and much less expanded than the left side.

All the *Exogyra* may be divided into two sections according to the form of this side with the muscle:—into those in which this side is vertical to the surface of greatest expansion in the shell, and then forms a sharp keel on the back,—and those in which this side expands somewhat in a wing-like form, with a rounded and not a projecting back; that is (1) the *Exogyra carinata*, and (2) the *Exogyra expansa*. Singularly enough these two divisions correspond to the geological occurrence of the genus;—the first section, or the *Exogyra carinata*, appearing especially in the lower; the other section, or the *Exogyra expansa*, mostly in the upper strata of the chalk deposits. These two divisions are represented in a remarkable manner by the *Exogyra Couloni*, or *aquila*, Goldfuss, and the *Ex. columba*; the first characteristic of the Néocomien, the second of the upper chloritic chalk [chalk-marl]. Throughout the whole of Europe this *Exogyra columba* is never looked for in vain, but in North America it has not yet been seen except in Texas, and there only of a small size (Römer). Its place appears to be supplied by the large, scaly, wide-expanded *Exogyra costata*, Say, which, according to Morton's statement, occurs wherever the cretaceous strata are found. On the other hand, the absence of *Exogyra Couloni* from this portion of America is quite in accordance with its position in the lower beds which are wanting in North America.

XXXVI.—*Descriptions of British Aphides*.

By FRANCIS WALKER, F.L.S.

[Continued from p. 281.]

82. *Aphis Pruni*.

Aphis Pruni, Fabr. Ent. Syst. iv. 213. 14; Syst. Rhyn. 296. 14; Gmel. ed. Syst. Nat. i. 2202; Geoffr. Ins. i. 497. 10; Degeer, Ins. iii. 49. 5. t. 2. f. 1-8; Reaum. Ins. iii. t. 23. f. 9-10; Scopoli, Ent. Carn. 138. 406; Rossi, Faun. Etr. 260. 1374; Stew. El. ii. 110; Turt. ii. 704; Schrank, Faun. Boic. ii. 115. 1217; Götze, Ent. Beitr. ii. 312; Latr. Gen. Cr. iii. 173; St. Farg. et Serv. Encycl. x. 245; Kaltenbach, Mon. Pfl. i. 52. 37; Ratz. Forst. Ins. iii. 216.

A. Arundinis, Fabr. Syst. Ins. 385. 7; Ent. Syst. iv. 212. 8; Syst. Rhyn. 295. 8; Gmel. ed. Syst. Nat. i. 2202; Kalt. Mon. Pfl. i. 54. 38.

Prunifex, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 476.

Calamaphis, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 477.

The viviparous wingless female. This *Aphis* dwells beneath the leaves of the plum-tree (*Prunus domestica*), and is said to feed also on *P. spinosa* and on *P. Armeniaca*, from the middle of June to the end of October. It exudes much floccose matter with which the leaves on which it feeds are covered; the body is light green, elliptical, long, narrow, and thickly covered with white powder: the limbs are white: the feelers have brown tips, and are much shorter than the body: the tip of the mouth, the feet, and the tips of the shanks are brown, and the eyes are darker: the nectaries are pale green with black tips, and about one-twentieth of the length of the body: the front is rather narrow, and nearly straight: the first and second joints of the feelers are not angular; the fourth joint is very much shorter than the third; the fifth is a little shorter than the fourth; the sixth is much shorter than the fifth; the seventh is more than twice the length of the sixth. It also sometimes appears in abundance on *Arundo Phragmitis* and on *A. Epigys*, and it assumes there a variety of tints, which will be mentioned when its history is more fully detailed.

The viviparous winged female. The pupa much resembles the larva, but is shorter, and the tips of the rudimentary wings are pale brown. The winged *Aphis* is also light green, and very much covered with white powder: the head, the middle chest, and the middle breast are black or gray: the feelers have the same colours, and vary in length, being a little shorter or much shorter than the body; the fourth joint is more than half the length of the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is more than

twice the length of the sixth: the eyes are dark red or black: the mouth is green or pale green; its tip and the nectaries are black, the latter are about one-twelfth or one-twentieth of the length of the body: the legs are pale green; the feet and the tips of the thighs and of the shanks are black: the wings are white or colourless and much longer than the body; the wing-ribs, the rib-veins and the wing-brands are pale green, the latter are sometimes pale brown; the other veins are brown; the first vein is more perpendicular than is usual in this group, and the second vein diverges much more from it than it does from the third; the first fork of the latter vein is a little after one-third and the second much more after two-thirds of its length; the fourth vein is curved moderately and equally throughout its length, and the angle whence it springs is very slight.

1st var. The legs are white; the feet and the tips of the shanks are brown.

The oviparous wingless female. The body is small, slender, nearly linear, rather flat, smooth, whitish green tinged with yellow, not shining: there is a dark green stripe along the back: the head is yellow: the feelers are black, pale yellow at the base and about half the length of the body: the eyes are dark red: the mouth and the nectaries are pale yellow with black tips, and the latter are hardly one-tenth of the length of the body: the legs are pale yellow and rather short; the knees, the feet and the tips of the shanks are black. On *Elymus* or *Calamagrostis arenarius*.

1st var. The body is green: the eyes are nearly black.

2nd var. The back of the body has a bluish tinge. On *Salsola Kali* in the beginning of October near Fleetwood.

The wingless male. Like the oviparous female, but smaller: the feelers are about half the length of the body.

Length of the body $\frac{1}{2}$ – $\frac{5}{8}$ line; of the wings $2\frac{1}{4}$ lines.

83. *Aphis Lythri*, Schrank.

Aphis Lythri, Schrank, Faun. Boic. ii. 1. 115. 1215; Kalt. Mon. Pfl. i. 51. 36.

Lythraphis, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 477.

The viviparous wingless female. This insect feeds on *Lythrum Salicaria* in the summer. It is small, pale green, oval, shining, and slightly convex: the feelers are pale yellow, and shorter than the body, their tips and the eyes are black: the mouth and the nectaries are also pale yellow with black tips, and the latter are as long as one-fourth of the body: the legs are pale yellow, and moderately long; the feet are darker. While young it is narrower and more linear. The front has three small tubercles; the first and the second joints of the feelers are not angular; the fourth is much shorter than the third; the fifth is a little shorter

than the fourth; the sixth is much shorter than the fifth; the seventh is more than twice the length of the sixth.

1st var. The body is dull yellowish green varied with red: the feelers are dull yellow, black towards their tips, and a little shorter than the body: the mouth is yellow with a black tip: the nectaries are dull yellow with black tips: the legs are yellow; the feet and the tips of the shanks are black.

Found in September, near Newcastle, by Mr. Hardy.

The viviparous winged female. The body is black and rather small: the borders and the underside of the fore-chest and the abdomen are dark yellowish green; the disc of the latter is black: the feelers and the nectaries are black, and the latter are nearly one-fifth of the length of the body: the legs are yellow; the feet and the tips of the thighs and of the shanks are black: the wings are colourless and very much longer than the body; the wing-ribs and the rib-veins are pale yellow; the brands and the veins are brown.

Length of the body $\frac{1}{2}$ line; of the wings 2 lines.

84. *Aphis Tussilaginis*, n. s.

The viviparous wingless female. This species was found in the latter part of October near Lancaster on *Tussilago Farfara*. The body is large, convex, narrow, linear and brown: the head is black: the feelers are pale yellow, and as long as the body; the tips of the joints are black: the mouth is pale yellow, and reaches the hind-hips; its tip and the eyes are black: the nectaries are pale yellow, black at the base and at the tips, and as long as one-fourth of the body: the legs are long and pale yellow; the knees, the feet, and the tips of the shanks are black. While young it is linear pale greenish yellow, and has a large lively green spot in the middle of the body.

1st var. The abdomen is yellowish brown: the feelers are black, pale brown towards the base, and nearly twice the length of the body: the nectaries are yellow with black tips; they are also black at the base, where there is a large spot of the same colour.

The viviparous winged female. The body is brown: the borders and the underside of the fore-chest are pale green: the abdomen is pale green with a row of narrow black bands along its back, and a row of black spots on each side: the feelers are black, and a little longer than the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are yellow with black tips, and as long as one-fourth of the body: the legs are long and yellow; the hind-thighs except the base, the feet, and the tips of the thighs and of the shanks are black: the wings are colourless; the wing-ribs and the rib-veins are pale yellow; the wing-brands and the other veins are brown.

85. *Aphis Dianthi*, Schrank.

Aphis Dianthi, Schrank, Faun. Boic. ii. 114. 1213; Kalt. Mon. Pfl. i. 42. 29.

A. vulgaris, Kyber, Germ. Mag. i.

A. Rapæ, Curtis, Journ. Roy. Agric. Soc. iii. 53. pl. C. fig. 1-3.

A. dubia, Curtis, Journ. Roy. Agric. Soc. iii. 54. pl. C. f. 4.

A. vastator, Smee, The Potatoe Plant, &c. 81.

A. Solani? Kalt. Mon. Pfl. i. 15. 5.

Dianthaphis, Amyot, Ann. Soc. Ent. Fr. 2^{de} série, v. 477.

The viviparous wingless female. The body is small, oval, dull, rather flat, pale yellowish green; it has a row of punctures and a slight rim on each side: the feelers are pale yellow, black towards the tips, and a little more than half the length of the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are pale yellow with black tips, and as long as one-sixth of the body: the tube at the tip of the abdomen is also pale yellow with a darker tip: the legs are pale yellow and moderately long; the knees, the feet, and the tips of the shanks are black.

1st var. The body is mottled with red.

2nd var. The feelers are longer than the body; the tips of the latter joints are darker: the nectaries are as long as one-fourth of the body: the legs are pale yellow; the tips of the feet are darker. When young it is pale yellow, linear and flat.

3rd var. The body is pale red.

4th var. Body rose-colour: the head is almost white: the limbs are white: the eyes, the feet, the tip of the mouth, and the tips of the nectaries are black: the feelers are nearly as long as the body; the nectaries are one-fifth of its length.

5th var. The body is pale yellowish green, tinged with red: the feelers are a little shorter than the body: the nectaries are as long as one-fourth of the body: the legs are pale greenish yellow; the feet and the tips of the shanks are black.

6th var. The body is pale red, slightly streaked with black: the head is yellow: the feelers and the mouth are pale yellow with black tips, and the former are longer than the body: the nectaries are pale yellow, and as long as one-fourth of the body; its tip and the eyes are black: the legs are yellow; the knees, the feet, and the tips of the shanks are black.

7th var. The body is pale whitish green: the feelers are pale green, black towards the tips, and much shorter than the body: the eyes are dark red: the mouth and the nectaries are pale green with black tips: the legs are pale green: the feet and the tips of the shanks are darker. On *Sonchus*.

8th var. The body is grass-green and shining: the head is pale yellow: the feelers are white, black towards the tips, and rather more than half the length of the body: the mouth is white with

a black tip : the tube at the tip of the abdomen and the nectaries are white ; the latter have darker tips and are as long as one-fourth of the body : the legs are greenish white ; the knees are brown ; the feet and the tips of the shanks are black.

9th var. Like the last, but the body is deep green and mottled with dark colour : the feelers are black, yellow at the base : the nectaries are pale yellow with dark tips : the thighs are green ; the shanks are yellow, with black tips.

10th var. The nectaries are slightly spindle-shaped.

11th var. The body is yellow : the borders of the abdomen are black : the feelers are black, yellow at the base, and shorter than the body : the mouth is pale yellow ; its tip and the eyes are black : the nectaries are yellow with black tips, and as long as one-fourth of the body : the legs are pale red ; the knees, the feet, and the tips of the shanks are black. Mr. Hardy, on *Urtica urens*.

12th var. The body is dull green tinged with buff : the feelers are pale yellow, darker towards their tips, and a little shorter than the body : the eyes are dark brown : the mouth and the nectaries are pale yellow with brown tips, and the latter are as long as one-fourth of the body : the legs are also pale yellow ; the feet and the tips of the shanks are brown. On *Carduus*.

13th var. The body is small, oval, convex, pale green, not shining, whitish towards the head. the feelers are pale yellow, black towards the tips, and longer than the body : the mouth is pale yellow ; its tip and the eyes are black : the nectaries are pale yellow with black tips, and about one-fourth of the length of the body : the legs are pale yellow, and rather long ; the knees, the feet, and the tips of the shanks are black. An *Aphis* of this variety has one hind-shank much longer than the other, and black in the middle as well as at the end.

14th var. The body is rose-colour mottled with pale yellow : the head and the limbs are yellowish white : the feelers are longer than the body ; the tips of the joints are black : the eyes are very dark red : the mouth and the nectaries have black tips, and the latter are about one-fifth of the length of the body : the feet are black.

15th var. The body is green, and shining.

16th var. The body is yellow.

17th var. The body is red.

18th var. The body is bright red.

19th var. The body is pale orange.

20th var. The body is streaked with black.

21st var. The body is nearly all black.

These colours vary in intensity, and are either separate, or mixed together on the body, which is sometimes dull, sometimes shining.

The limbs also vary in colour : the feelers are rather less or

rather more than the length of the body; their colour passes from pale yellow or pale green to brown or black; the dark colour begins at the last joints and at the tip of each joint, and spreads thence over the whole feeler: the eyes are bright red, or dark red, or brown, or black: the mouth is dull yellow, or pale yellow, or green, or pale green; its tip is brown or black: the nectaries likewise vary in colour, they have black or brown tips, and are one-fourth or one-fifth of the length of the body: the legs have the same variations in colour, and also vary slightly in length; the feet and the tips of the thighs and of the shanks are brown or black; the thighs are paler than the shanks, and the dark colour in the former sometimes occupies half their length; the hind-shanks and even the hind-thighs are sometimes but very rarely brown or black: the limbs as usual are almost white when the skin has been lately shed.

The viviparous winged female. While a pupa it is red: the feelers are yellow, black towards the tips, and as long as the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are pale yellow with black tips, and as long as one-fourth of the body: the legs are pale red; the feet and the tips of the shanks are black: the rudimentary wings are whitish or pale green, or with brown or black tips. When the wings are unfolded the insect is black: the borders of the fore-chest, the fore-breast, and the abdomen are greenish yellow: the feelers are hardly shorter than the body: the mouth is pale yellow with a black tip: the nectaries are black, and as long as one-sixth of the body: the legs are pale yellow; the feet and the tips of the thighs and of the shanks are black: the wings are colourless, and much longer than the body; the wing-ribs and the rib-veins are pale brown; the other veins are brown.

1st var. The body is dull green varied with black and red: the feelers are pale yellow towards the base, and a little longer than the body.

2nd var. The body is rose-colour: the limbs and the rudimentary wings are white.

3rd var. The body is black, and very small: the abdomen is dull green: the feelers are much shorter than the body: the mouth is dull yellow with a black tip: the nectaries are black, and as long as one-sixth of the body: the legs are yellow; the feet and the tips of the thighs and of the shanks are black: the wing-ribs are pale yellow; the wing-brands and the veins are pale brown.

4th var. While a pupa it is pale greenish yellow: the feelers are yellow, brown towards the tips, and a little shorter than the body: the nectaries also are yellow with brown tips, and nearly one-fifth of the length of the body: the legs are pale yellow; the feet, and the tips of the shanks are brown.

The winged *Aphis* is as variable in colour as the wingless: it

is greenish black, or black, or brown, or pale brown, or bright yellow: the borders of the fore-chest and the fore-breast are yellow, or red, or reddish brown, or green: the abdomen is yellow, or green, or dark green, or reddish brown tinged with green; its disc is usually more or less black, and it has sometimes one or two rows of black dots on each side: the feelers are black, but sometimes pale green at the base: the mouth is green, or pale green, or pale yellow; its tip is black: the tube at the tip of the abdomen is yellow: the nectaries are sometimes only one-sixth of the length of the body: the greater part of the hind-thighs is sometimes black, and more rarely all the thighs are black from the middle to the tips, or even from near the base to the tips: the wing-ribs are pale yellow, or pale green, or yellowish white; the rib-veins and the wing-brands are pale yellow or pale brown; the other veins are pale brown or brown.

Length of the body $\frac{1}{2}$ line; of the wings 2 lines.

Variations in the wing-veins. The third vein has no second fork.

It feeds on the following plants:—

Thalictrum minus.	Leontodon taraxacum.
Ranunculus bulbosus.	Plantago lanceolata.
hirsutus.	Mentha hirsuta.
repens.	Heliotropium Peruvianum.
acris.	Beta vulgaris.
Aquilegia vulgaris.	maritima.
Papaver Rhæas.	Calceolaria pinnata.
Fumaria officinalis.	Callistemma.
Nasturtium officinale.	Tussilago.
Cochlearia Armoracæa.	Geranium Robertianum.
Alliaria officinalis.	Spergula arvensis.
Erysimum barbarea.	Bunias Kakile.
Capsella Bursa-pastoris.	Galium Mollugo.
Cakile maritima.	Crocus.
Brassica oleracea.	Dianthus Caryophyllus.
Rapa.	prolifer.
campestris.	Tulipa.
Napus.	Fuchsia coccinea.
Sinapis arvensis.	globosa.
alba.	micrantha.
nigra.	Narcissus.
Raphanus sativus.	Mesembryanthemum.
Raphanistrum.	Hyacinthus.
Dianthus.	Verbenæ.
Euphorbia Peplus.	Tropæolum tricolor.
Crepis tectorum.	Solanum tuberosum.
Potentilla anserina.	Polygonum Persicaria.
Pyrethrum inodorum.	Pimelea sylvatica.
Myosotis scorpioides.	Myrtus.
Inula dysenterica.	Citrus.
Digitalis.	Ruscus androgynus.
Sonchus.	Cactus.

And on many other hot-house, green-house, cultivated and wild plants which will be mentioned in a future notice of this Aphid.

The following extracts from the observations of Mr. William Curtis in the year 1800 refer chiefly to this species, or to *A. Malvæ*, on columbine :

“In very cold weather Aphides are oviparous, for this obvious reason : the eggs are capable of resisting cold more powerfully than the young. On the 22nd of November I found a considerable number of eggs which had been deposited in some auricula plants by a small green Aphis, which infests plants very generally, while the same *species*, on a geranium that I kept within doors, produced young. In mild winters I have observed in the month of January the same species of Aphis in great numbers on the same species of *Primula*, without doors, and all the females viviparous. These are facts that prove that all *Aphides* are not oviparous and viviparous at the same season, but that some may be wholly viviparous ; that all such as are both oviparous and viviparous do not lay eggs towards the middle of autumn, nor at all during the winter, unless a certain degree of cold takes place.” “Seasons sometimes occur very irregularly indeed, on an average, perhaps, once in four or six years, in which they (the *Aphides*) are multiplied to such an extent that the usual means of diminution fail in preventing them from doing irreparable injury to certain crops. In severe winters we have no doubt but that *Aphides* are very considerably diminished ; in very mild winters we know that they are very considerably increased ; for they not only exist during such seasons, but continue to multiply.” “The common green Aphis, which is so generally destructive, lives during the winter season on such herbaceous plants as it remained on during the autumn, either in its egg or perfect state. If the weather be mild, it multiplies greatly on such herbage ; as the spring advances, in May the males and females of these insects acquire wings : and thus the business of increase, hitherto confined, is widely and rapidly extended.”

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 27, 1849.—Wm. Yarrell, Esq., Vice-President, in the Chair.

MONOGRAPH OF THE LARGE AFRICAN SPECIES OF NOCTURNAL LEPIDOPTERA BELONGING OR ALLIED TO THE GENUS SATURNIA. BY J. O. WESTWOOD, F.L.S. ETC. (Continued from p. 306.

Section C.

Sp. 13. SATURNIA EPIMETHEA. *S. alis anticis subfalcatis ; subfuscis striga communi subapicali obscura extus pallide griseo*

marginata; *macula minuta mediana triangulari vitrea*; *posticis acute angulato-caudatis*, *ocello magno medio fulvo iride nigra annulo puniceo cinereoque cincta*, *marginē antico alarum obscuriori*.

Expans. alar. antic. unc. 5-6.

Hab. in Guinea. In Mus. Britann.

Syn. *Phalæna Attacus Epimethea*, Drury, vol. ii. pl. 13. fig. 1; Fab. Ent. Syst. iii. a. p. 414; Gmel. Linn. Syst. Nat. 2404; Cramer, Ins. t. 176 A; Oliv. Enc. Méth. v. 29.

The antennæ of the male are rather small, with only 34 rays on each side, thirteen of the apical joints being destitute of rays. The palpi are small and distinct, rather dependent, but not extending beyond the hairs of the face.

Sp. 14. SATURNIA ALCINOË, Cramer. *S. alis anticis falcatis rufo-badiis*; *anticis costa lata alba, striga communi recta transversa prope basin, fascia lata alba pone medium in qua striga recta fusca*; *anticis macula mediana vitrea subquadrata, posticis ocello ovali pupilla vitrea, iride lata fulva, annulo nigro circumdata*.

Expans. alar. antic. circ. unc. 6.

Syn. *B. Alcinoë*, Cramer, pl. 322 A. *B. Caffraria*, Stoll, Suppl. Cram. pl. 31. fig. 2 & 2 e. *Saturnia Caffra*, Boisduval in Delegorgue, Voy. dans l'Afrique Austr. ii. p. 601.

Hab. in Caffraria, Amazoolu. In Mus. Britann.

The palpi are distinct and slender, but do not extend beyond the hairs of the clypeus. The antennæ of the males have 54 rays on each side, the two basal rays of each joint converging inwardly and being bent more obliquely, so that the tips of the rays form four distinct rows; all the rays are moreover set on more obliquely than in the typical species. The antennæ of the female are moderately pectinated, the two apical rays of each joint being almost obliterated. A beautiful figure of this species is given in Mr. Angus's plate of Zoolu Moths, fig. 15.

Sp. 15. SATURNIA ALINDA, Drury. *S. alis rufo-brunneis margine externo saturationi strigisque variis undulatis obscuris præsertim pone medium, macula semiovali mediana vitrea, posticis ocello magno pupilla vitrea iride fulva annulo nigro cincta*.

Expans. alar. antic. unc. $7\frac{3}{4}$.

Hab. Sierra Leone.

Syn. *Phalæna Attacus Alinda*, Drury, Illustr. iii. pl. 19; Oliv. Enc. Méth. v. p. 26. 10.

I have not seen a specimen of this species.

Sp. 16. SATURNIA PHÆDUSA, Drury. *S. alis anticis falcatis griseo-fuscis anticis strigis tribus transversis saturationibus maculaque parva triangulari mediana vitrea*; *posticis obscurioribus ocello maximo pupilla minuta vitrea, iride lata nigra annulis concentricis anguste sanguinea, pallide punicea, et ferruginea circumcincta*.

Expans. alar. antic. unc. $7\frac{3}{4}$.

Hab. Sierra Leone. In Mus. Britann.

Syn. *Phalæna Attacus Phædusa*, Drury, Illustr. iii. pl. 24 & 25.

Bombyx Saturnus, Fab. Ent. Syst. iii. a. p. 409 ; Oliv. Enc. Méth. v. 27. 11.

The palpi are short and thin, but distinct. The antennæ are short, each joint emitting four rays lying flat.

The specimen in the British Museum collection is pale russet-coloured beneath with a pinkish bloom, the centre of each wing with a group of brown spots much larger in the hind- than in the fore-wings; a small brown spot also occurs at the base of the hind-wings.

Sp. 17. SATURNIA TYRRHENA, Westw. *S. alis anticis falcatis griseo-fuscis basi rubidis, striga undulata prope basin alteraque lunulata subapicali fuscis, macula parva mediana subtrigona vitrea; limbo apicali rufo; alis posticis rufis ocello magno ovali nigra pupilla parva vitrea; striga undata obscuriori, limbo lato pallide griseo-fusco.*

Expans. alar. antic. unc. 4-5½.

Hab. Port Natal. In Mus. Britann.

The fore-wings are pale greyish-brown, sometimes with a reddish tinge; they are acute at the tip in both sexes, but the outer margin is considerably more emarginate than in the female; the base of the wing is red, and near the base is a red, very much angulated striga almost suffused into the ground colour of the wing, and outwardly edged with a slight dusky striga; across the middle of the wing is a waved but nearly obsolete striga, and in the middle of the wing towards the fore-margin is a small subtriangular vitreous spot without any appearance of ocellus; beyond the middle is a row of reddish arches inwardly slightly edged with a thin dusky line.

The hind-wings are reddish, with a broad pale greyish-brown border; in the middle of the wing is a large round black spot, with a very small vitreous lunar spot in the middle, preceded and followed by a slight dusky waved striga. The body above is of the ground colour of the wings, with the hind part of the thorax marked with red. The underside of the body, collar, and spot at the base of the hind-wings are white. The head, antennæ and legs dark brown.

The wings beneath are very pale buff, with the centre of each marked by a large brown irregular spot, traversed by the pale veins.

Antennæ of the male with 32 rays on each side (four from each joint). One-third of the apical part of each antenna is destitute of rays.

The antennæ of the female are slightly pectinated for two-thirds of the base, the two apical rays of each joint being almost obsolete. The tips are serrated.

The palpi are deflexed, and the tips appear just beyond the hairs of the lower part of the face.

Var. Smaller, with the fore-wings and body destitute of the red colour, and the hind-wings fulvous with the outer margin purplish-grey, with the eye as in the others.

Sp. 18. SATURNIA FORDA, Westw. *S. pallide griseo-fusca* ♂, *pallide cervino-lutea* ♀, *striga subobsoleta pone medium, posticis*

etiam ocello parvo subvitreo, fusco, medio; alis posticis maris angulato-subcaudatis; feminae rotundatis.

Expans. alar. antic. unc. $4\frac{1}{2}$ – $4\frac{3}{4}$.

Hab. in Natalia. Mus. Brit.

Male with the fore-wings very slightly emarginate along the outer margin; hind-wings produced into a strong angle in the middle of the hind-margin; all on the upper side of a silky, pale brownish-grey, uniform colour, traversed by a slightly distinct, slender, brown striga beyond the middle. The hind-ones marked moreover in the middle with a small, round, dusky spot, having an indistinct vitreous lunule in the middle, and surrounded by an indistinct whitish circle. The antennæ are dark brown; those of the male are moderately bipectinated, each having about thirty-six rays on each side, a few of the apical joints being destitute of rays, and some of the preceding having the second ray gradually becoming obsolete. The female antennæ are only slightly serrated, the second spur on each side of each joint being obliterated. The veins are those of the typical *Saturniæ*.

The female has the body and wings of a pale reddish buff, with the dusky striga beyond the middle almost obliterated, and the dusky spot in the middle semicircular. On the underside the hind-wings have also a small oval dark spot towards the base.

Sp. 19. SATURNIA ANGASANA, Westw. *S. alis anticis apice acutis isabellinis, fascia pallide grisea ante medium, strigaeque tenui oblique fusca pone medium maculaque parva semi-orali vitrea mediana; posticis ocello magno nigro, pupilla minuta vitrea, annulis concentricis testaceo, puniceo-albo, et sanguineo cincta.*

Expans. alar. antic. unc. $5\frac{3}{4}$.

Hab. apud Portum Natalensem. In Mus. Britann.

Isabelle-coloured or pale rufous brown, with an irregular pale greyish bar before the middle, followed by an oblique darker fascia, on the outside of which is a small semi-oval tale-like spot; beyond this, extending from near the tip of the wings towards the middle of the inner margin, is a nearly straight, slender, darker line, edged with greyish on each side; the apical margin of the wing beyond the dark line becoming grey, shaded off to the ground colour of the wing. The hind-wings have a large ocellus, black in the centre, with a minute vitreous dot in the middle, with a red lead-coloured ring outside the black, followed by a fleshy-coloured one, and this by a purple-carmine one: the outside of the ocellus rests upon a dark, slender, curved line. The collar and underside of the body whitish; head and legs darker olive-brown; antennæ black.

Wings beneath pale reddish buff, of a redder brown near the tip, with the dusky subapical line as above, and the vitreous spot preceded and followed by a dark claret-brown spot: hind-wings destitute of the ocellus, which is replaced by an indistinct claret-brown spot, followed by a red-brown fascia, widest at the anal margin. Near the base is also a small brown spot.

The antennæ of the female are serrated, the two terminal rays of each joint nearly obliterated, with one-fourth at the apex simple.

This species is figured by Mr. Angas in his plate of Amazooulu Lepidoptera, fig. 16.

Sp. 20. SATURNIA ACETES, Westw. *S. alis anticis apice acutis obscure fulvis striga valde undulata cinerea prope basin ocello mediocri mediano fusco et vitreo strigaeque recta fusca subapicali, posticis magis ferrugineis ocello magno medio pupilla vitrea, iride nigra annulo albo cincta strigaeque tenui transversa fusca recta prope medium* (♀).

Expans. alar. antic. unc. $6\frac{1}{2}$.

Hab. apud Caput Palmarum (D. Savage). In mus. nostr.

The fore-wings are of a dark reddish fulvous colour, tinged with red-brown between the middle and the apex. Near the base is a very irregular, rather indistinct, ashy-purplish striga, and in the middle of the wing is an oval moderate-sized ocellus, the basal half being brown, and the apical half vitreous, the latter surrounded by a slender brown line; halfway between this ocellus and the apical margin of the wing is a straight, slender, brown line, running from near the apex of the wing towards the middle of the inner margin. The hind-wings are of a much redder hue, especially on the anterior portion, with a slight appearance of the sub-basal ashy striga of the fore-wings near the base; the middle of the wing occupied by a large ocellus, with a vitreous centre, having a rather broad greyish-black iris surrounded by a white ring, the outer extremity of which rests on a slender dusky striga running from near the outer angle of the wing towards the middle of the anal margin. The body is rich brownish fulvous, with an ashy-brown collar and legs. The antennæ black and very slightly pectinated in the female, consisting of about thirty-five joints, the first twenty-five emitting a pair of short slender branches from the base, the tip of the joints being also slightly serrated; the ten terminal joints are shorter, each emitting a single branch set on in front of each joint, the branches of the preceding joints being set on the upper and lower edges.

The wings beneath are paler buff-brown, with a broad, subapical, dusky bar, undulated externally; the eye of the fore-wings less distinct, and that of the hind-wings replaced by two brown spots and a vitreous patch. Near the base of the wings is also a round brown dot.

Sp. 21. SATURNIA ISIS, Westw. *S. alis griseis nigro fuscoque irroratis, striga fusca valde dentata ante medium alterisque duabus nigris pone medium, ocello parvo vitreo antice nigro; posticis ocello maximo ornatis, pupilla nigra postice subvitrea, iride obscure fulva annulisque concentricis nigro, subluteo, pallide carneo, purpureo-rufescenti, iterumque carneo et pone hanc striga curvata nigra, apice obscure albido limbo griseo.*

Expans. alar. antic. unc. $5\frac{3}{4}$.

Syn. *Saturnia Isis*, Westwood in Jard. Nat. Library, Entomol. vol. vii. p. 138. pl. 13. *S. Maia*, Klug, Neue Schmett. t. 5. fig. 1 (nec *Ph. Maja*, Drury, Ill. vii. pl. 24. fig. 3).

Wings of a very pale grey colour, especially the anterior pair, which are almost entirely covered with fine black and brown scales.

The centre of these wings is ornamented with a small oval ocellus, the basal half of which is covered with black scales, and the outer half is vitreous: between this and the base is a very curved and irregularly dentate dark striga, and immediately behind the eye is a nearly straight, slender, brown bar. This is succeeded by slender black wavy bars, the space between which and the apex of this wing is divided as it were into three compartments, the first of which is covered with small brown scales; the second is paler, and covered with very fine black speckles, and the apical part is much darker, with large black speckles; the apical margin of the fore-wings is slightly waved. The hind-wings are entirely covered on the upper side by a most magnificent eye-like spot, surrounded by successive rings of various colours. The oval pupil is black, but the part furthest removed from the body is denuded of scales, and would be vitreous were not the underside of the wings clothed with scales: this is surrounded by a narrow fulvous iris; then black; then a broader oval ring of dirty clay colour; then a narrow oval of pale flesh-colour; then a broad, rich, claret, oval ring: between this and the base of the wing is first a bar of flesh-colour, then black, shaded into claret; towards the extremity of the wing the claret is succeeded by a half-ring of flesh-colour; then a narrow one of black; then of pale buff stone-colour, and another moderately broad of grey speckled with black, extending to the extremity of the wings. The thorax is dark and rich brown coloured, with two white bands across the neck and two across the extremity of the thorax whitish; the abdomen is buff, with black dots. The margin of the wings is scalloped.

Beneath, all the wings are very pale buffish white with dark speckles; the fore-wings are marked nearly as on the upper side, but the hind-wings have only a very small eye in the centre, having a black pupil with a fulvous orbit surrounded by a slender black circle; immediately connected with the posterior part of this eye is a curved row of brown arches, between which and the apex of the wings is another and more slightly marked series of black scallops. The palpi are distinct, forming a small brown muzzle, but they are not visible from above; they, as well as the rest of the head, are brown. The spiral tongue appears to be wanting. The antennæ of the male are considerably elongated, with the rays bent backwards instead of lying flat, and there are eighty-eight rays on each side of the antennæ, the rays extending to the tip, so that the antennæ are composed of about forty-four or forty-six joints. The antennæ of the female are setaceous, and only slightly bipectinated, being gradually more slender from about one-third of the distance from the base to the apex, each joint emitting four rays, the joint at each point of emission being swollen.

The female has the wings rather shorter, and not at all emarginate along the apical margin.

Sp. 22. SATURNIA NICTITANS, Fabr. *S. alis margine apicali integro, fusco incarnatis medio obscuriore, striga tenuissima angulata prope basin alteraque recta subapicali fuscis punctoque parvo medio vitreo; posticis concoloribus ocello magno*

medio pupilla parva vitrea, iride flava, annulis nigro, puniceo et albo cincta, strigaeque transversa nigra subapicali.

Expans. alar. antic. fere unc. 5.

Hab. in Africa tropicali. In Mus. Banks. (Soc. Linn. Lond.), Mus. Britann. et nostro.

Syn. *Bombyx nictitans*, Fab. Ent. Syst. iii. a. 413.

The antennæ of the male are 39-jointed, with fifty-eight rays on each side (four from each of the twenty-nine or thirty basal joints), the rays lying nearly flat.

The antennæ of the female are about 42-jointed, only slightly serrated, each joint having two serratures on each side, the basal one being most prominent, the antennæ becoming gradually more slender to the tips. The palpi are short, but distinct and deflexed.

Sp. 23. SATURNIA ALOPIA, Westw. *S. alis anticis fusco-albidis, striga recta puniceo-alba ante medium maculaque parva triangulari mediana vitrea, strigaeque postica recta fusca externe puniceo-tincta, posticis etiam bistrigatis ocelloque parvo vitreo, iride obscure lutea circulo nigro alteroque late puniceo-albo circumdata.*

Expans. alar. antic. unc. $4\frac{1}{4}$.

Hab. — ? In Mus. Britann.

Fore-wings brownish buff, with a pale pinkish white, nearly straight fascia across the wings before the middle, edged towards the base with a fine dark line, the other side shaded off to the ground colour of the wings; beyond the middle is a small triangular vitreous spot, bounded at the base by the transverse veinlet closing the discoidal cell; beyond the middle is a straight, slender, dark striga, edged with pale pinkish white; the outer margin of these wings slightly emarginate; hind-wings entire, somewhat oval, brownish buff, the middle with a pale rosy tint, bearing an ill-defined whitish fascia towards the base, and another, followed by a dusky line, beyond the middle; the middle of the wing occupied by an ocellus, with a small glassy centre, surrounded by dirty buff, and this by a black circle and a larger, pale pinkish white one; thorax in front with a white transverse fascia; antennæ dark brown.

The antennæ of the male are small, moderately short, the rays flat, thirty-four rays on each side, one-fourth of the antennæ at the tip being destitute of rays.

The palpi are distinct, but small.

Sp. 24. SATURNIA ETHRA, Westw. *S. alis omnibus apice undulatis, anticis subfalcatis, posticis in medio in caudam truncatam productis; fusco-albidis fusco irroratis, anticis dimidio basali pallidiore, strigis tribus fuscis undatis 2da magis distincta mediana et cum ocello parvo medio conjuncta; posticis ocello maximo; pupilla lunata vitrea iride nigra circulo tenui luteo, 2do nigro, 3tio latiore luteo-fulvo, 4to albo; striga basali angulata alterisque duabus pone medium undulatis nigris; parte antica alarum puniceo-rufa.*

Expans. alar. antic. unc. $5\frac{3}{4}$.

Hab. — ? In Mus. D. Loddiges.

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The fore-wings of this fine species are rather narrow and subfalcate, with the apical margin rather waved; they are of a buff-brown, very much irrorated with darker scales, the basal half of the wing and costa being much paler; they are traversed by three very oblique brown strigæ, of which the middle one is the thickest; the anterior one is very much waved and dentated, the second much-waved, having attached to it near the middle of the wing a small oval ocellus, of which the anterior half is brown and the other half vitreous: the third fascia arises on the costa from a larger brown spot. The hind-wings are similarly coloured to the apical portion of the fore-ones, except that the anterior portion is of a rich pinkish red which extends half round the ocellus, which is large and central, having a small semicircular vitreous pupil surrounded by a black iris round which is a very slender luteous ring, and another black, followed by a pinkish-buff broader ring, and this by a white one. Across the base of the wing is a brown angulated striga, being the continuation of the central one of the fore-wings, and from the inner margin of the ocellus runs a waved one to the anal margin, followed by another running across the wing parallel to the apical margin. The apical part of the wing is much freckled with brown, and a thin brown line runs just within the margin. The thorax is dark brown, with a pale buff collar; the hind-part pale, with a short black bar. Wings beneath coloured as above, except that the fore-ones are tinged on the inner margin with pink, which colour is entirely wanting in the hind-wings, which are more freckled with brown than above, the ocellus being replaced by a small brown spot.

The pectinations of the antennæ of the only specimen I have seen (which is probably a female) are comparatively short, each antenna having thirty-eight rays on each side (four from each joint), and about one-fourth of the antennæ at the apex is destitute of rays. The palpi are very small, but distinct.

This fine insect is unique in the collection of Conrad Loddiges, Esq., of Hackney, who is not aware of its locality; but from its relationship to *S. Isis*, I have but little doubt of its being a native of Africa.

Section D.

Sp. 25. SATURNIA LUCINA, Drury. *S. alis anticis falcatis, posticis rotundatis, omnibus albido-griseis fusco multum rivulosis strigis undulatis submarginalibus, anticis maculis nonnullis mediis ocelloque parvo apicali nigris.*

Expans. alar. antic. unc. $6\frac{3}{4}$.

Hab. Sierra Leone.

Syn. *Phalæna Attacus Lucina*, Drury, Illustr. iii. pl. 34. fig. 1; Oliv. Enc. Méth. v. 31.

I have not seen any specimen of this insect, the veins of which agree rather with *Saturnia* than *Lasiocampa*, although the antennæ seem but narrowly pectinated.

Sp. 26. SATURNIA NENIA, Westw. *S. alis anticis apice rotundatis; plumbeo-nigris apicibus magis fuscis luteoque irroratis striga tenui irregulari nigra obliqua, ante medium alteraque*

minus distincta at magis obliqua, et ad costam valde angulata, macula media irregulari albida; posticis nigricanti-fuscis basi puniceis macula magna media pallide flava.

Expans. alar. antic. unc. $4\frac{1}{4}$.

Hab. apud Caput Palmarum (D. Savage). In mus. nostro.

This curious species has the fore-wings broad, with the fore-margin rather suddenly angulated beyond the middle, and with the apical margin rounded, the extreme tip forming a small, rounded, slightly detached lobe. The general colour of the wing is a dark leaden-coloured blackish-brown, slightly irrorated with fulvous scales, especially towards the tip of the wing, which is rather paler and more varied than the rest. At about one-third from the base runs an oblique, black, irregular striga, which is followed by another more slender and indistinct, and more slanting, being suddenly strongly angulated near the costa, where it terminates in a strong black dash. Between the strigæ is an ill-defined fulvous-buff patch in the middle of the wing. The hind-wings are blackish brown, with the base pink, and with a large, very pale yellow patch in the middle. The body is blackish brown and slightly irrorated. The abdomen is much swollen in the only specimen I have seen. Beneath, the wings are very much freckled with grey, black, buff and white, especially beyond the middle; the fore-wings have a large patch of rose-pink along the inside at the base, followed at some distance by a rather broad, very pale yellow bar; the hind-wings want the pink colour, but have the pale yellow patch as on the upper side.

The antennæ of the female consist of twenty-two joints, emitting only a pair of rays from the base of each, the apical pair being indicated by a very slight serration, followed by about twelve joints at the tip which are destitute of rays. The palpi are porrected into a short distinct muzzle.

From these characters it will probably be necessary to form this species into a separate subgenus, when the male shall be known. The veins of the wings are arranged as in the typical *Saturniæ*.

Sp. 27. SATURNIA HERILLA, Westw. *S. alis apice undulatis, anticis angulatis brunneo-fulvis valde irroratis, medio fulvescenti fascia obliqua fusca abbreviata; posticis macula magna sulphurea, limbo lato fusco, fulvo irrorato.*

Expans. alar. antic. unc. $4\frac{3}{4}$.

Hab. Sierra Leone (D. Morgan). In Mus. Brit.

Wings fulvous-brown, much varied with darker and lighter shades, and with numerous small dark dots and streaks; the base with a grey shade much-mottled with small dark brown patches; before the middle of the wing is an ill-defined, pale, nearly square patch, resting on the median vein, but extending narrowly along the costal margin, which is much marked with dark dots; the middle of the wing is more uniformly fulvous brown, with a dark, very oblique dash arising from the costa, which is considerably curved beyond the middle: a dark brown oval patch also rests on the middle of the last branch of the median vein; the apical margin of the wing is scalloped and dark

brown, preceded by a paler patch marked with undulating fulvous-brown lines; the hind-angle of the wing being much dotted with different shades of fulvous and brown. The hind-wings have a large sulphur-white patch occupying the base of the wings, except the extreme base, which is pink. The remainder is brown, varied with minute fulvous spots, the anal angle being more mottled.

On the underside the wings are paler and richer coloured, more decidedly mottled; the fore-wings having the base suffused with pink. The veins are fulvous.

The antennæ are but slightly pectinated.

The body is fulvous-brown, the thoracic portion tinged with pink.

Sp. 28. SATURNIA AGATHYLLA, Westw. *S. alis anticis subfalcatis posticis denticulatis; supra pallide rufo-fulvis (in specimine nostro unico valde detritis), in medio ut videtur exocellatis.*

Expans. alar. antic. unc. $3\frac{5}{8}$.

Hab. Congo. In Mus. Brit.

A single specimen only of this insect exists in the British Museum, having the wings so completely denuded of scales, except at the base, that it is impossible to give a detailed character; their outline is however entire. The anterior ones are subfalcate, and the hind ones are denticulated along the outer margin, the tooth at the extremity of the middle branch of the median vein being the most acute. All that remains of the colouring of the fore-wings is a reddish-fulvous buff, which seems indeed to have extended all over these wings, as well as over the hind-wings, which are suffused with pink on the upper side towards the anterior margin. On the under side the wings are coloured as above; the fore-wings are also suffused with pink along the posterior margin at the base, and they, as well as the hind-wings, have the anterior margin somewhat streaked transversely with brown. I can discern no trace of eyes in the middle of the wings. The body both above and below is fulvous brown, as are also the antennæ and legs.

The basal joint of the antennæ is clothed beneath with a thick mass of hairs; each is furnished with eighty rays, each of the twenty joints succeeding the basal one emitting four rays, one close at the base and one close at the apex on each side, the inside of the two on each side being furnished with fine hairs, the tips of which come in contact with each other. The thirteen terminal joints are destitute of rays. The palpi are quite distinct, but scarcely extend beyond the hairs of the face.

Section E.

Sp. 29. SATURNIA (HENUCHA) GRIMMIA, Hübner. *S. alis anticis nigris albo irroratis lunulisque magnis albis, ocello medio fulvo maculam medianam virgatam includente; posticis basi puniceis medio albis maculis duabus nigris, majori ocellum fulvum (cum lunula alba) includente, limbo nigro albo irrorato, maculis marginalibus albidis.*

Expans. alar. antic. circ. unc. 3.

Hab. Africa meridionali.

Syn. *Phalæna (Henucha) Grimmia*, Hübner, Exot. Schm. F. 3, 4.

Sp. 30. SATURNIA (HENUCHA?) DELEGORGUEI, Bdv. *S. alis anticis (maris) valde falcatis; posticis subtriangularibus; omnibus (fœminæ) subrotundatis et parum sinuatis; anticis brunneis basi costa et limbo apicali cinerascentibus, pone medium macula parva vitrea angulata; posticis basi et antice roseis, limbo fusco, striga alba; medio nigro, ocello fulvo, lunula vitreo annuloque nigro.*

Expans. alar. antic. unc. $2-2\frac{1}{4}$.

Hab. in Terra Amazoolu, et apud Portum Natalensem. In Mus. Britann.

Syn. *Saturnia Delegorguei*, Boisduval in Delegorgue's Voyage dans l'Afrique Austr. ii. p. 601.

The antennæ of the male are 32-jointed, each of the fourteen basal joints emitting four rays, the second ray in one joint and the first of the following joint being close together, and only gaping at the tip: one-third of the antennæ at the tip is simple; the rays are set on at right angles, lying flat. The antennæ of the female are very shortly pectinated on each side, except about one-fourth of the length at the tip. The veins of the wings differ from those of the typical *Saturniæ* in having the outer branch of the post-costal vein arising from the middle of the transverse veinlet which closes the discoidal cell, and the two small vitreous spots, forming the angulated spot above described, rest on the outside of the veinlet, being divided from each other by the outer branch of the post-costal vein.

Sp. 31. SATURNIA (HENUCHA?) SMILAX, Westw. *S. alis anticis maris valde falcatis obscure fulvis (♂) seu griseo-fuscis (♀), fascia lata obliqua livida seu castanea utrinque linea tenui pallida marginata, anticis plaga magna subtriloba vitrea; posticis lunula parva media vitrea.*

Expans. alar. unc. $2\frac{1}{2}-2\frac{3}{4}$.

Hab. Port Natal. In Mus. Britann. et Saunders.

The fore-wings of the male are rather narrow and very much hooked at the tip, and angulated beyond the middle of the costa, fulvous brown, palest along the fore-margin, with a rather broad, very oblique fascia a little beyond the middle of the wing, of a rich chestnut colour, shaded to purplish towards the costa; nearly straight along the fore-edge, but much-arched on the outer margin, both edges being marked with a pale, slender, buff line: beyond the middle of the fore-wing is a large, irregular, somewhat trilobed vitreous spot, outwardly edged with a dark line, and succeeded by a pale buff one. The apical portion of the wing beyond the fascia is fulvous buff, shaded to brown in the middle, and to purple. There is also a small dark dot in the middle of the costa.

The hind-wings are fulvous, the middle with a darker oblique fascia tinged with purple, with a pale line on each side; the outer margin curved, and in the middle of this fascia is a small lunate vitreous spot.

The female has the fore-wings slightly waved along the outer margin: the general colour of the wings is darker and more ashy than in the male, the fulvous colour replaced by ashy brown.

The head and a large patch on the thorax are dark fulvous brown in the male, chestnut in the female.

The antennæ of the males are scarcely pectinated beyond the middle; there are twenty-two rays on each side. The apical half simple, with only numerous short setæ at the extremity of the joints. The antennæ of the female are quite simple and setaceous. The veins of the wings are arranged as in the last species, the ocellus of the fore-wing resting on the outside of the transverse veinlet closing the discoidal cell, and being divided into two parts by the outer branch of the postcostal vein*.

Sp. 32. SATURNIA (UROTA) SINOPE, Westw. *S. alis anticis integris, posticis breviter caudatis; anticis fulvo brunneis fasciis duabus albis singula strigam fuscam includente, punctoque parvo ovali media alba, posticis livide puniceis puncto medio albo fasciæque pone medium alba.*

Expans. alar. antic. unc. 3.

Hab. apud Portum Natalensem. In Mus. Britann.

The wings of the male are entire and nearly straight; along the apical margin they are buff-brown or pale reddish brown, with a transverse white bar before and another beyond the middle, each edged on each side with a thin black line, and bearing a black streak along its middle. In the middle of the wing is a small oval white spot edged with black. Hind-wings livid pink, with a white spot in the middle, followed by a white fascia: apical portion of the wing fulvous brown, produced into a short, broad, somewhat triangular tail, obtuse at the tip.

Beneath similarly marked, but with all the colouring dull. Body, legs and antennæ fulvous brown.

The antennæ are rather short, and consist of forty-eight joints, each joint with one short ray on each side; the rays set on obliquely and directed backwards, the tips of the rays being turned forwards.

There are no traces of palpi to be perceived. The veins of the fore-wings are arranged as in the typical *Saturniæ*.

Sp. 33. SATURNIA (APHELIA) APOLLINARIS, Bdv. *S. alis externe rotundatis albis venis nigricantibus, anticis maculis duabus parvis mediis flavis fusco-cinctis; apice nigricanti striga communi extus dentata cum margine postico parallela, margine fusco-nigricanti maculis flavis ornato; abdomine albo apicibus segmentorum flavidis; serieque dorsali laterali et ventrali punctorum nigrorum, pronoti margine antico flavido.*

Expans. alar. antic. fere unc. 3.

Hab. apud Portum Natalensem. In Mus. Britann.

Syn. *Saturnia Apollinaris*, Boisduval in Delegorgue's Voyage dans l'Afrique Australe. ii. p. 601.

The texture of this insect, as described by Boisduval, is "mince et délicate"; the same author states that it is "tout autant une Liparide

* Mr. Angas has represented this species in his plate of Amazoolu Lepidoptera, figure 12.

qu'une Saturnide." The veins of the fore-wings are however arranged as in the typical *Saturniæ*; but the antennæ are different, consisting of about thirty-six joints, bipectinated in both sexes with only thirty-four rays on each side, each joint except one or two at the apex emitting only a pair of rays, which are rather short. The palpi are distinct and turned upwards, extending rather further than the hairs of the face: the spiral tongue is distinct.

Boisduval states that this species "vole en plein jour. Une année, aux environs de Port Natal, on aurait pu en prendre par centaines en quelques heures. Deux ou trois jours après il n'existait plus. La femelle que nous est inconnue ne vole pas, peut-être même est-elle aptère, et tous les mâles voltigeaient sans doute à sa recherche." The female is however winged and scarcely distinguishable from the male, as I have ascertained by extracting eggs from the abdomen of a specimen in the British Museum collection, which M. Boisduval would doubtless have taken for a male.

The structure of the antennæ and presence of a spiral tongue, together with the fragile texture of the insect, will require a subgenus for its reception.

May 22.—Harpur Gamble, Esq., M.D., in the Chair.

The following papers were read:—

1. DESCRIPTION OF SOME CORALS, INCLUDING A NEW BRITISH CORAL DISCOVERED BY W. MACANDREW, ESQ.
By J. E. GRAY, ESQ., F.R.S. ETC.

As yet only a single living species of recent stony coral has been recorded as inhabiting our coast. I am aware that M. Milne-Edwards and M. Haime have described the Torbay coral as belonging to two species and to different genera, viz. *Desmophyllum Stokesii*, Ann. Sci. Nat. ix. 255. t. 7. f. 12, 12 a, and *Cyathina Smithii*, l. c. ix. 288; but from the varieties in form, and especially in the contraction of the base, which I have seen in specimens on the same stone, I believe the genera and species have been established on very unessential characters.

I may state, that from the observations I have been able to make, I believe that the recent corals are very much more influenced by external circumstances, by the rarity or the abundance of food that the animals are able to procure, and by the roughness or quietness of the water they happen to inhabit, and the stations they may accidentally occupy, than the describers of corals even the most recent are willing to allow. This greatly added to the difficulty of distinguishing the species; and if this is the case with the recent corals which we receive in a good state, how much more difficult must it be to distinguish those only found in a fossil, and often in a worn and imperfect condition!

The British coral here noticed is perfectly distinct from the former, and from any European coral that has come under my examination; and when I showed it to M. Milne-Edwards and M. Haime on their

late visit to this country, they stated that it was quite unknown to them, and most nearly allied to an Australasian species. It belongs to the genus *Flabellum*, established by the late M. Lesson in his 'Illustrations of Zoology' in 1831 for a coral from the Japanese Seas. And more lately (in 1841) Dr. A. Philippi established a genus under the name of *Phyllodes* for some fossil allies. Dana, in his work on Zoophytes in 1846, has applied the name of *Euphyllia* to this genus. Quoy and Gaimard referred one of the species to the genus *Turbinolia*.

The only specimen of the coral found by Mr. MacAndrew is unfortunately in an imperfect state, having been broken by the dredge, and I have some doubts if it absolutely belongs to the genus *Flabellum*, as it appears rather to form a more or less circular expanded disk, than a compressed wedge-shaped body. But Messrs. Milne-Edwards and Haime appeared to have no doubt of its belonging to that genus when it was shown to them, and I have therefore adopted their opinion until more perfect specimens are found to verify or correct our knowledge. It may be described as follows:—

FLABELLUM MACANDREWII.

Coral expanded, subcircular?; outline irregular, torn, with acute marginal processes; outer surface smooth, polished, as if varnished; septa thin, far apart, very finely crenulated on the edge in three series; the primary plates large, the secondary nearly as large, but much more narrow near the centre; the tertiary plates small, very narrow.

Hab. North Sea.

The single imperfect specimen here described was found about twenty-five miles from East Shetland, in ninety fathoms water.

Mr. MacAndrew has kindly presented the specimen to the British Museum collection.

M. Milne-Edwards and M. Haime, in their monograph of the genus *Flabellum*, published in the 'Annales des Sciences Naturelles,' ix. p. 256 (in 1848), describe forty-three species, and divide them into three sections, thus:—

a. Coral becoming free by the progress of age.

* Coral becoming free by the cessation of the adherence of the pedicel—*Flabellines pédicellés*.

** Coral becoming free by the rupture of its base—*F. tronquées*.

b. Coral always fixed by its enlarged base—*F. fixées*.

The last section is very distinct from the two former, and might almost form a separate genus, for which I should be inclined to retain Dana's name of *Euphyllia*.

The other two sections are separated from one another by very slight characters, which I believe are not even sufficient to separate the specimens of the same species, for some specimens from the same localities retain their narrow base, while in others this part is more or less truncated.

Indeed from the numerous specimens of this genus which I have

been enabled to examine in the Japanese boxes which are sent to the Canton market, and from thence to London, and others brought from Northern China by Mr. Fortune, I have little doubt that the species is very variable. I had come to this conclusion, and arranged all the specimens together in one tray in the British Museum, before Messrs. Milne-Edwards and Haime came to examine the corals in the Museum for description in their papers in the 'Annales des Sciences Naturelles' for 1848; and the examination of the characters given by these naturalists for their several species has not induced me to change my opinion, which has, on the contrary, been strengthened by a second comparison.

I may state that we have in the British Museum two very distinct recent species:—1. *Flabellum affine*, Edwards and Haime, n. 31. t. 8. f. 10, from Australia, which has very close plates. 2. *Flabellum Pavoninum*, n. 1, from Japan and North China. And Milne-Edwards and M. Haime have described another from the Falkland Islands, brought to France by M. Dupetit Thouars, and hence called *Flabellum Thouarsii*, n. 10. t. 8. f. 5, which appears to be distinct from the two former.

From the examination of the numerous specimens of *Flabellum Pavoninum* which I have been enabled to compare and collect, I am inclined to believe that all the specimens which are brought from the Japanese Seas belong to a single species, which I believe will include as varieties the following species described by M. Milne-Edwards and M. Haime, viz.:—

1. *Flabellum distinctum*, n. 2. The specimen in the British Museum, from which this species is described, came from Japan, and not the Red Sea, as stated in the work cited.
2. *F. debile*, n. 23. t. 8. f. 2.
3. *F. Sumatrense*, n. 24.
4. *F. spinosum*, n. 25. t. 8. f. 4.
5. *F. aculeatum*, n. 26. t. 8. f. 3.
6. *F. compressum*, n. 20 = *Fungia compressa*, Lamk.
7. *F. Bairdii*, n. 32. From Japan.
8. *F. Cumingii*, n. 33. t. 8. f. 11.
9. *F. elongatum*, n. 34. t. 8. f. 7.
10. *F. profundum*, n. 35. China (Fortune). *F. spheniscus*, n. 42?
11. *F. crassum*, n. 36. t. 8. f. 8.
12. *F. crenulatum*, n. 37.
13. *F. elegans*, n. 38. From Japan; B. M.
14. *F. Candeanum*, n. 39. t. 8. f. 13.
15. *F. Stokesii*, n. 40. t. 8. f. 12.
16. *F. Owenii*, n. 41. t. 8. f. 9.

I thought at first that these specimens might be separated into two, according to the colour, some being red, with the sides of the coral keeled, and others white, with the sides more or less rounded; *Flabellum Pavoninum*, Lesson, being the type of one species, and *Fungia compressa*, of Lamarck, of the other. But there are specimens red on one side and white on the other, and some on the other hand keeled on one edge and rounded on the other; some with elongated spines

on one edge, and spiniferous or only with a slight tubercle on the opposite one; sometimes one edge has two spines and the other only one, or a tubercle, and the extent of the truncation of the base differs in every example.

The same examination has also induced me to believe that the specimen which these authors have described under the name of *Placotrochus lævis*, p. 283. t. 8. f. 15, is only a variety of the same species; and that *Acanthocyathus Grayii*, 293. t. 9. f. 2, is only a specimen of the same species which has lost its compressed form. I have not seen *Rhizotrochus typus*, p. 282. t. 8. f. 16, or *Blastotrochus nutrix*, p. 284. t. 8. f. 14; but from the figures, I have great suspicions that they are only modifications of the same species.

To give some idea of the variations produced by local causes in corals, I may state that the specimens which Messrs. Milne-Edwards and Haime have described under the generic name of *Heterocyathus*, are only specimens of the genus *Cyathus* which have been changed in form from their having grown attached to a spiral shell which was inhabited by parasitic crustacea. I have specimens showing all the grades of change, from the nearly normal conical form of the genus to the truncated form which has been described as the type of the genus *Heterocyathus*. This form was well-described by Spengler in 'Nova Acta Hafniæ,' i. 240, and noticed by Gmelin under the name of *Madrepora Cochlea*, p. 3763.

Messrs. Milne-Edwards and Haime described two species of this genus under the names of *H. æquicostatus*, t. 10. f. 8, and *H. Roussæanus*, t. 10. f. 9. Of the former he appears only to have seen a single specimen. We have in the British Museum three very distinct species, which may be thus described:—

1. II. COCHLEA = *Mad. Cochlea*, Gmelin, S. N. *H. æquicostatus*, Milne-Edwards and Haime, 324. t. 10. f. 8.

Coral subcylindric, hard, white, with narrow, equidistant, distinct grooves, crenulated on the edges; base rather dilated; laminæ narrow, sharp-edged, very unequal, grooved on each side, and with crowded columns in the centre of the star.

Hab. Chinese Seas.

The holes on the outer surface are large and distinct.

2. H. HEMISPHERICA.

Coral subcircular, depressed, subhemispherical, nearly flat below, regularly convex above; sides rounded; plates of star broad-topped, as if truncated, covered on top and sides with very numerous crowded spines and tubercles; centre of star roundish, with small columella.

Hab. Chinese Seas.

The plates of this species resemble those figured as belonging to *H. Roussæanus*, l. c. 325. t. 10. f. 9; but the shape of all the two specimens in the Museum, which are nearly similar, is quite distinct from the view of the side of that species.

3. H. EUPSAMMIDES.

Coral polymorphous, base flat, sides shelving, sinuous, surface covered with very close, irregular, sinuous, denticulated ridges, and

pierced with numerous minute pores; star irregular, compressed or sinuous; laminæ narrow, then cribellated on the surface, and with an oblong, elongated, convex, cribellated centre.

Var. star more or less contracted in the centre, forming two more or less distinct roundish stars.

Hab. Chinese Seas.

This species is immediately known from the former by the peculiarity of the surface, which is like that of *Caryophyllea ramea*, and by the convex elongated form of the centre of the star.

I have described these three species together on account of their having the same form and habit, but the structure of the surface and the great difference in the form and conformation of the stars induce me to believe that they probably belong to three very distinct families of corals.

Since I described these corals I have shown the two latter species to M. Milne-Edwards, who states that they had not before come under his observation.

LINNÆAN SOCIETY.

May 24, 1849.—The Lord Bishop of Norwich, President, in the Chair.

This day, the anniversary of the birth of Linnæus, and that appointed by the Charter for the Election of Council and Officers, the President opened the business of the day, and the Secretary read the following notices of those Members of the Society with whose decease he had become acquainted during the year.

Sir John Barrow, Bart.

George Bennett, Esq.

Edwin Charles Charlton, Esq.

Edward Forster, Esq., the late lamented Treasurer of the Society, was the third son of Edward Forster, Esq., for fifty-two years Governor of the Russia Company of London, and was born at Walthamstow in the county of Essex on the 12th of October 1765. He passed the greater part of his childhood in the neighbourhood of Epping Forest, and from the age of fifteen became particularly attached to the study of English botany, which he ardently cultivated through a long and active life. He was a partner in the eminent banking-house of Lubbock, Forster and Company, and to within a few hours of his death took a leading part in the business of the bank. In 1800 he was elected a Fellow of the Linneæan Society, of which he became Treasurer in 1816, and one of the Vice-Presidents in 1828; and his kindness of disposition, unremitting attention to his duties, and zeal for the interests of the Society, will long endear his memory to all its members. He was a man of very active habits; rising daily at 6 o'clock, usually spending an hour before breakfast in his garden, in which he cultivated many of the rarer and more obscure British species, and taking a great deal of bodily exercise, which, together with his extreme temperance, probably contributed greatly to the prolongation of his life. His death, which took place in the 84th year of his age, at his residence,

Ivy House, Woodford, on Wednesday the 21st of February in the present year, was occasioned by an attack of cholera, contracted, as was supposed, a few days previously at the Refuge for the Destitute, of which valuable charity he had long been a most zealous and liberal supporter. He was buried on the 1st of March in the family-vault at Walthamstow, in the immediate neighbourhood of which his whole life had been spent.

Mr. Forster possessed a very complete and well-arranged herbarium of British plants, and particularly devoted himself to those of his native county of Essex; and he had long entertained the intention of publishing its "Flora," the manuscript of which he has left in an imperfect state. His contributions to our 'Transactions' are limited to two papers; the one "On *Vicia angustifolia*, Smith," in vol. xvi.; and the other "On *Esula major Germanica* of Lobel," in vol. xvii.

George Gardner, Esq., was born in Glasgow in May 1812, and was educated for the medical profession in the University of that city. He displayed at an early period a taste for the study of natural history, but botany in particular was his favourite pursuit. At that time Sir William Hooker filled the Chair of Botany in that University, and Mr. Gardner so far attracted his notice as to lead him to open to him the range of his fine herbarium, and allow him the free use of his extensive botanical library. The ardent zeal of the young student urged him to make the best use of these rare advantages, and his progress was great and rapid. His numerous attainments and many excellent qualities soon obtained him the steady friendship of his generous teacher, and he continued the pursuit of his studies till the end of 1835, when having expressed his eager desire to explore the botanical treasures of tropical climates, Sir William Hooker obtained the cooperation of twenty-four subscribers who contributed towards the expenses of his journey and agreed to purchase sets of the dried plants he proposed to collect, while a number of others engaged to receive from him such living plants as he might select on account of their beauty or rarity. Among the latter was the late Duke of Bedford, who was one of the young botanist's most liberal patrons, and Brazil was selected as the most appropriate field for his exertions.

Previous to his departure, he published a pocket herbarium entitled 'Musci Britannici,' on the plan of Funke's 'Deutschlands Moose,' where dried specimens illustrative of each species were neatly fixed according to the arrangement in Hooker's 'British Flora.' Mr. Gardner embarked at Liverpool on his projected expedition in May 1836, and arrived in July following at Rio de Janeiro. The receipt of his first set of 400 species, collected on the Corcovado and mountain ranges immediately surrounding that city, showed how faithfully and successfully he discharged the duties of his mission, and proved the harbingers of the extremely fine collection he subsequently made in the interior of Brazil. The next field of his exertions was the lofty range of the Organ Mountains covered with primæval forests, which he explored with great success, being the first to scale the loftiest peak of that range, where he obtained much to reward his

exertions. His activity was unceasing, and his time entirely devoted with the greatest ardour to a pursuit which presented him with so many novelties and opened to him so attractive a career. During his researches among the riches of this fertile region he acquired such a knowledge of the Portuguese language, and studied so to adapt himself to the habits of the people, as to enable him to carry into effect his original design of traversing the interior provinces of Northern Brazil, in quest of their botanical productions, which until that period had only been investigated by Pohl, Von Martius, A. St. Hilaire, and our countryman Dr. Burchell, and were comparatively little known to botanists in general. With this view he embarked at Rio de Janeiro, and reached Pernambuco in July 1837: he spent three months in exploring that province, visiting the Rio San Francisco, which he ascended as high as the falls of Pedro Affonço; hence he returned to Pernambuco, and proceeded by sea to Aracaty, from which point he penetrated inland, making very large collections in the provinces of Ceara and Piauhý. His intention was to cross to the westward and explore the banks of the Tocantins, and ascending along the course of that river to penetrate by this route as far as the city of Goyaz, and if possible to reach the cities of Cuyaba and Matto Grosso; but the political disturbances then raging in Piauhý obliged him to alter his course in a more southerly direction: this had the advantage of offering a long tract yet untrodden by any botanist, and he accordingly traversed the westernmost portion of the province of Pernambuco and crossed the more eastern parts of that of Goyaz, examining in his way the high table-lands in these districts, which afforded him a rich harvest. Crossing then the Serra Geral, near Arrayas, he entered the province of Minas Geraës, where he added greatly to his collections, especially among the rarities of the Diamond district, and after traversing this entire province he again reached Rio de Janeiro at the end of 1840. Hence he paid a second visit to the Organ Mountains and the rich mountain country in the neighbourhood of the Parahyba River, and finally embarked with his collections for Liverpool, where he arrived in July 1841, having been absent five years and two months, during which period his collections amounted to upwards of 6000 species of Phanerogamous plants, consisting of fine and well-selected specimens, in excellent preservation.

His many interesting letters to Sir William Hooker, written at various stages during his travels, were published from time to time in the 'Companion to the Botanical Magazine,' the 'Annals of Natural History,' and the 'Journal of Botany;' but in 1846 he prepared a more popular Account of his Journey, which was published in an 8vo volume under the title of 'Travels in the Interior of Brazil.' He likewise contributed, after his return to England, several botanical memoirs to the 'London Journal of Botany' on *Chresta*, *Pycnocephala*, *Trochopteris*, *Bowmannia*, *Hockinia*, and several other new genera; and in 1842 he commenced an Enumeration and description of the plants he had collected during his travels, which he continued to publish from time to time in the same journal. In 1843, in conjunction

with Mr. Fielding, he published a 'Sertum Plantarum,' containing figures and descriptions of many of the novelties of that gentleman's collection, and he also contributed several other descriptions of his plants for Hooker's 'Icones Plantarum.' He became a Fellow of the Linnæan Society in 1842; and published in the 19th volume of our 'Transactions' a paper "on *Peltophyllum*, a genus allied to *Triuris*."

In September 1843, at the recommendation of his friend Sir Wm. Hooker, he received from Government the appointment of Superintendent of the Botanic Garden of Ceylon. The first object of his ambition in entering upon the duties of this appointment was the formation of a complete Flora of Ceylon, to which he constantly devoted his time and energies. In order to compare the relations of the botany of Ceylon with that of the Southern Peninsula of India, he made an excursion to Madras in the beginning of 1845, where he had the opportunity of consulting the rich herbarium of Dr. Wight, in company with whom he herborized extensively in the Neilgherry Mountains, where he formed a very interesting collection. After his return to Ceylon he made several journeys into the interior, and to many distant parts of the island, adding thus constantly and extensively to his collections. During five years he made great progress in the accumulation of materials towards his projected Flora, which he expected to complete for publication in 1851. In allusion to this great object of his ambition he wrote in 1844: "I trust to be able to publish, in the course of a few years, a Flora of the island worthy of the richness and beauty of its vegetation and of the encouragement afforded me by the home and local Governments. This, however, as you are well able to judge, will be a work of no little labour, as it must contain descriptions of from 4000 to 5000 species, being considerably more than half of the plants defined by Linnæus in the last edition of his 'Species Plantarum.'"

He returned about the middle of last year from one of his long excursions made in company with Sir Emerson Tennent to Jaffna, Trincomalee, and the eastern districts of the island: subsequently he was constantly occupied in examining and registering the characters of the plants of the large collection made during that journey, and frequently complained of pain in the head, which he attributed to too close application to these sedentary pursuits. He therefore gladly availed himself of an invitation from Lord Torrington, Governor of the island, to join him at Newera Ellia, the famed Sanitarium of Ceylon, to which place he repaired on the 10th of March last. He arrived there in excellent spirits, at three in the afternoon, and after lunching with the Governor and his family retired to rest after his long ride, when he was suddenly attacked by a fit of apoplexy, which rendered him quite insensible, and of which he died in a few hours. In communicating this sad news by the last overland mail, Lord Torrington, Sir Emerson Tennent, and many other persons of consideration in the island, spoke of it not only as an irreparable public loss, but expressed extreme regret upon being thus suddenly deprived of an invaluable friend, for whom they felt the

most sincere affection; for Mr. Gardner possessed in a rare degree the faculty of making friends in every direction. The cheerfulness of his disposition, his never-tiring energy, the variety and extent of his acquirements, his desire to impart information wherever required, his vivacity and pleasing conversational powers, secured him wherever he went the esteem and friendship of all well-informed persons.

Thus has been suddenly cut off in the prime of his life one of the most active of the practical botanists of the day. It is much to be desired that the work which he has advanced so far towards completion may not be lost to science, and that a successor may be found fully competent to arrange the large mass of materials already accumulated; and in carrying out this object, it is to be hoped, the merit which belongs to this deserving botanist will be recorded to the full extent of his due. Independently of the labours already noticed, Mr. Gardner had just completed for publication a 'Manual of Indian Botany;' an elementary work of that nature having been long a great desideratum to the numerous students of botanical science in India. In addition to his contributions before mentioned, he published in the 'Calcutta Journal of Natural History,' several interesting memoirs, viz. on the *Cyrtandraceæ* of Ceylon, on *Anstrutheria*, *Sarcandra*, &c., *Carria*, *Dysodidendron*, *Leucocodon*, and on *Christisonia*, &c., together with a valuable paper on the *Podostemaceæ* of the island and of Southern India, to which he added descriptions of the plants of this order met with during his travels in Brazil.

William Gordon, Esq., M.D.

William Horton Lloyd, Esq., well known to us all as one of the most constant attendants on our Meetings, and for his liberal feelings and kindness of disposition, was born at Chapel-Allerton in the neighbourhood of Leeds in the year 1784. His family, although not boasting any great descent, were very respectable manufacturers in Manchester. He was himself destined for the bar, and studied the law for a considerable time; but conscientious scruples with regard to the oath induced him to relinquish his idea of adopting the legal profession, and he devoted himself to the cultivation of his taste for natural science and antiquities, for which he had a strong predilection. He became a Fellow of the Linnæan Society in 1807, and was also a Fellow of the Society of Antiquaries, and one of the earliest Members of the Zoological Society, of the Horticultural Society, of the British Association, and of several other scientific and literary institutions. For the Linnæan Society in particular he always entertained the warmest regard; and although he never published anything, he constantly took a deep interest in the progress of science. He died at his house in Park Square on the 18th of February in the present year, having suffered for a year or two previously several slight paralytic attacks, but retaining his faculties little impaired almost to the last.

Alexander MacLeay, Esq., for more than a quarter of a century Secretary to this Society, was born in the county of Ross on the 24th of June 1767. His father, who was Provost of the town of

Wick, was also a Deputy-Lieutenant of the county of Caithness, and the representative of one of the most ancient families in the north of Scotland. Mr. MacLeay was educated for commercial pursuits, which he relinquished early in life, and became in 1795 Chief Clerk in the Prisoners of War Office, in 1797 head of the department of Correspondence of the Transport Board, and in 1806 Secretary of that Board, which office he filled until the abolition of the Board in 1818, when he retired upon a pension. In the year 1825 he was solicited by the late Earl Bathurst to undertake the important office of Colonial Secretary to the government of New South Wales, which he held until the close of 1836. Having fixed his residence in the colony, with which he had now become completely identified, he was chosen in 1843 to be the first Speaker of the Legislative Council then established; and in that capacity conducted himself with so much ability, judgment and impartiality, as to receive on his retirement from its duties in May 1846 the marked approbation of both sides of the House.

In 1794 Mr. MacLeay became a Fellow of the Linnæan Society, and in 1798 he succeeded Mr. Marsham in the office of Secretary, which he held until his Colonial employment compelled him to relinquish it in 1825. The following Minute of Council on that occasion, which was subsequently adopted by a General Meeting of the Society, expresses the high sense universally entertained by the Members of his long and useful services:—

“The Linnæan Society of London take the earliest opportunity after the retirement of Alexander MacLeay, Esq. from the Secretaryship of the Society, to record upon their Minutes the high estimation in which he is held by them on account of twenty-seven years of unremitted and unrequited labour devoted to the interests of science; and that in quitting for a time this sphere of usefulness to fill an honourable station in a distant country, he carries with him the cordial esteem and sincere regret of this Society.”

As a naturalist, Mr. MacLeay devoted himself almost exclusively to the study of insects, of which he had formed, previous to his quitting England, the finest and most extensive collection then existing in the possession of a private individual. Of this great class of animals he possessed an intimate knowledge, without, however, having published anything on the subject, although he had made preparations for a monograph of the singular genus *Paussus*, in which his cabinet was peculiarly rich. He became a Fellow of the Royal Society in 1809, and was also a Foreign Member of the Academy of Sciences of Stockholm, and a Corresponding Member of the Academy of Turin.

Mr. MacLeay married early in life a relation of the house of Barclay of Urie, by whom he had a numerous family. He died at Sydney, New South Wales, on the 18th of July 1848, in the 82nd year of his age.

William Pilkington, Esq.

Robert James Nicholl Streeten, M.D.

John Frederick Walter, Esq., M.D.

Among our *Foreign Members*, the Society and the scientific world have sustained a severe loss by the death of

Stephan Ladislaus Endlicher, Professor of Botany in the University of Vienna, and Director of the Botanic Garden of that city. He was born at Presburg on the 24th of June 1804, and there acquired his school education. His higher studies were pursued partly at Pesth and partly at Vienna, where in 1823 he became a pupil of the Archiepiscopal Seminary, being then destined for the church. But after the completion of his theological education, and when he had already taken the minor orders, family circumstances determined him to re-enter the secular state in 1826. Two years afterwards he was attached to the Imperial Library at Vienna, and the circumstances of his parents placed him in a state of easy independence. From the time of his quitting the ecclesiastical profession he devoted himself enthusiastically to the study of natural history, and more especially of botany, and to that of the languages of Eastern Asia, particularly Chinese. In botany he soon acquired so distinguished a reputation as to mark him out for the Keepership of the Herbarium in the Imperial Cabinet of Natural History; and in 1840, on the death of Baron Jacquin, he became Professor of Botany and Director of the Botanic Garden, which establishment he exerted himself greatly to reorganize and improve.

Of the numerous and important works, which have proceeded from his pen, the '*Genera Plantarum*' is that on which his fame will chiefly rest, as a work of immense labour, great research and profound botanical science. It will long continue to be a book of standard reference to the systematic botanist, of whose labours it is a constant and indispensable companion.

In private life Professor Endlicher was a most excellent and amiable man. He died at Vienna on the 28th of March of an apoplectic attack, caused as some physicians presumed by an effusion of pus from the *pars petrosa* of the left side into the brain, as he had suffered for many years from a polypus in the ear. On the previous Monday he had received his friends with his usual calmness and serenity, complaining only of a slight headache; but at midday on Wednesday he lost his speech and became insensible, and about seven o'clock in the evening he ceased to exist, leaving a large circle of warmly attached friends to deplore his premature loss.

Two *Associates* have also to be added to the list of deaths:—

Mr. David Cameron and *Mr. William M'Nab*.

At the election which subsequently took place, the Lord Bishop of Norwich was re-elected President; William Yarrell, Esq., was elected Treasurer; John Joseph Bennett, Esq., Secretary; and Richard Taylor, Esq., Under-Secretary. The following five Fellows were elected into the Council in the room of others going out, viz.: Thomas Bell, Esq., Francis Boott, M.D., John Gould, Esq., John Hogg, Esq., and Richard Horsman Solly, Esq.

Among the presents announced by the Secretary were the following:—

The herbarium of the late Thomas Walter, Esq., author of the '*Flora Caroliniana*;' presented by John Fraser, Esq., A.L.S.

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A Portrait of the late Sir Joseph Banks, Baronet, K.B., painted by the late Thomas Phillips, Esq., R.A.; presented by Captain Sir E. Home, Bart., R.N.

A Lithographed Portrait of the Right Rev. the Lord Bishop of Norwich, Pres. L.S., by T. H. Maguire; presented by G. Ransome, Esq., F.L.S.

There were also presented by W. A. Bromfield, M.D., F.L.S., specimens of a *Luzula* growing abundantly at Apse Castle, near Shanklin, Isle of Wight, and described by Dr. Bromfield as having the divaricate and reflexed panicle of *L. pilosa*, with the fruit of *L. Forsteri*, excepting that the seeds are scarcely above one-third or one-fourth the size of those of the latter species. The capsules (not yet ripe) seem to be naturally smaller than in *L. Forsteri*, and much shorter than the sepals, which thus appear to conceal them. Besides their much smaller size, the seeds of the plant exhibited appear to be rounder than in *L. Forsteri*, with a still shorter and very obtuse appendage, and to come later to maturity than in that or *L. pilosa*, as was shown by the accompanying specimens of both, in which the capsules had attained to nearly their full dimensions, whilst those of the new plant were much less advanced. This new form is the prevailing one at Apse Castle, greatly exceeding either of the two others or *L. sylvatica* (which also grows there) in quantity, and is extremely plentiful on dry sloping banks amongst bushes, and either growing alone or intermixed with the other three. The form of the seeds proves, in Dr. Bromfield's opinion, that it cannot be a variety of *L. pilosa*, whilst their very small size and the form of the capsule militate against its connection with *L. Forsteri*. So far as yet observed, the plant is taller than either of these, with longer roots and lower stem leaves; the leaves as broad as in *L. pilosa*, and from their greater length more lax or drooping at their extremities. The panicle, though much like that of *L. pilosa*, would seem to be less compounded, and narrower or more oblong in contour, and this last character coupled with the small size of the capsules first drew Dr. Bromfield's attention to what he would otherwise have regarded as merely *L. pilosa*. It seems improbable that it should be a hybrid between *L. pilosa* and *L. Forsteri*, being so much more plentiful than the assumed parents, to say nothing of the very minute seeds, so different in this respect from those of either. Dr. Bromfield has not met with it as yet in any other locality but that above mentioned.

June 5.—Thomas Horsfield, M.D., V.P., in the Chair.

Read a paper "On *Ichneumon Atropos*, Curt." By George Newport, Esq., F.R.S. & L.S.

Several years ago the author obtained many specimens of this insect both in the larva and perfect states at Canterbury, chiefly in the year 1829, but he has not met with them since 1834. He has taken the perfect insect in the month of July, and has many times reared it from the larva state in which it is a parasite within the body of the larva of *Sphinx ligustri*, on which he considers it to be more common than on that of *Acherontia Atropos*. Mr. Newport gives

some account of the habits and circumstances of its growth. It occurs in the body of the *Sphinx* larva and in the pupa from August to the following April, at which time it changes to a nymph, and remains in this state for a month to six weeks and comes forth in June. The anatomy of the larva was then described and shown to be in every particular in strict accordance with the condition of life under which this parasite exists, and confirmatory of the view of the author that the habits of different species are invariably in accordance with peculiarities of function, and that these are dependent mainly on differences of detail of structure.

BOTANICAL SOCIETY OF EDINBURGH.

March 14, 1850.—Professor Fleming, President, in the Chair.

Mr. M'Nab exhibited a specimen of *Stenocarpus Cunninghami* in flower; a flowering spadix of *Areca triandra*, a palm which perfected its fruit in the Botanic Garden last season; and a cluster of male flowers of *Chamærops humilis*.

Dr. M'Donald exhibited a specimen of the leaf of *Phormium tenax* grown in Argyllshire. The leaf was 6 feet 3 inches long, and $5\frac{1}{4}$ inches broad. He stated that the plant thrives well in that part of Scotland, without any protection during winter. He also mentioned that in many places on the Mull of Cantyre, myrtles, hydrangeas, fuchsias, and other delicate plants, succeed admirably, without protection.

Mr. M'Nab exhibited a specimen of *Potentilla tridentata*, sent by Mr. Westwood as a part of the plant picked by him and Mr. C. Stewart, on Ben Wyvis, Ross-shire, about ten years since. Mr. M'Nab undertook to investigate the Ben Wyvis station for this plant during the ensuing season.

Mr. M'Nab also exhibited from Mr. Ramsay a specimen of red fibrous matter attached to wood, taken from the wooden water-house of the Water Company on the Pentland Hills. The substance appeared to be very peculiar, and was remitted to Dr. Greville for examination.

Specimens of plants from the Quitinian Andes were presented from W. Jameson, Esq., of Quito, arranged according to their localities, as follows:—

I. Specimens of the Flora of Pomasqui and San Antonio, lat. $0^{\circ} 0'$: height above the level of the sea 8697 feet.

II. Plants from the level of Quito, lat. $0^{\circ} 13' S.$: altitude 9524 feet above the level of the sea.

III. Plants from the Region of Shrubs, from 11,000 to 13,000 feet above the sea level.

IV. Those of the lofty range of the Andes, as Pichincha, Chimborazo and Antisana, from 13,000 to 15,500 feet above the level of the sea.

Specimens of plants from Simla were exhibited from Lieut. R. Maclagan. Simla is in lat. $31^{\circ} 6' N.$; long. $77^{\circ} 13' 22'' E.$ Altitude, 7040 feet.

Temperature.			
	Maximum.	Minimum.	Rain in inches.
1841.	83°·5 June 8.	29°·0 Jan. 22 and 23.	
1842.	82°·0 May 31.	27°·5 Feb. 5	61·226.
1843.	81°·8 June 19.	31°·5 Jan. 10	93·147.
1844.	77°·3 „ 22.	24°·3 Jan. 13 and 15.	103·938.
1845.	78°·2 „ 20.	29°·3 Feb. 17.	116·363.
1846.	.....	.....	113·145.
Mean.	54°·29		

Dr. Balfour read a description of *Sabal umbraculifera*, a palm which is now in fruit in the Botanic Garden. It has a stem of 9 or 10 feet in height, still covered by the bases of the fallen leaves, which, in the progress of development, become split in a curious way at the place where they join the stem. The plant has thirty flabelliform fronds, the petioles of which are 12 feet in length, and the laminae 7 or 8 feet long, with about 100 laciniae or folds. The branching spadices are 6 feet in length; they are surrounded by numerous partial spathes, and at present exhibit enormous clusters, containing several thousand fruits of the size of large grapes. The fruit has a fleshy mesocarp, and contains only one perfect seed, which has a brown spermoderm, a cartilaginous white uniform perisperm, and a small dorsal embryo. Specimens of the large fruiting spadix, the split petiole, and reticulum of the palm, were exhibited.

Dr. Balfour also described *Phoenix sylvestris*, a specimen of which is flowering at present in the Botanic Garden. This palm has pinnate fronds 7 or 8 feet in length, and a spatha which splits on one side at its upper part, forming a boat-shaped crowning of the spadix. A specimen of a spathe inclosing a branching spadix of male flowers was exhibited.

Dr. Douglas MacLagan read the following Notice regarding some articles of the Vegetable Materia Medica.

Prunus Virginiana.—Under this name, borrowed from the United States' Pharmacopœia, a bark has, during the last year or so, been employed in considerable quantity in this country as a medicine, and has found favour with several medical men. This, it is presumed, is the bark which is officinal in the United States, and which, though bearing in the Pharmacopœia, U.S., the designation of *Prunus Virginiana*, is not the bark of the plant which was so named by Linnæus. The *Prunus Virginiana* of Linnæus is a small shrub, resembling *Cerasus Padus*, bearing a small dark red globular astringent fruit, which is known in America by the name of Choke Cherry. The *Prunus Virginiana* of the United States' Pharmacopœia is the bark of a tree of from 60 to 100 feet high, the *Cerasus serotina* (DC.), the Wild or Black Cherry of the Americans, but which Michaux appears to have confounded with the shrubby plant, and has also named *Cerasus Virginiana*. Sir W. Hooker, in the 'Flor. Boreal. Amer.,' adopts Michaux's name for the large tree, but has obviously transposed the two names, for he quotes Linnæus's synonym of *Prunus Virginiana* for the large tree, and applies the name *C. serotina* (DC.) to the

shrubby plant, and calls the fruit of the large tree Choke Cherry, whereas it should be Wild Cherry or Black Cherry.

Hooker's description of the large tree, under the name of *Cerasus Virginiana*, corresponds with that given by Wood and Bache, in the United States' Dispensatory, of the same tree, under the name of *C. serotina*, DC., with the synonym *C. Virginiana* of Michaux, and answers to specimens sent from Canada by Dr. Philip MacLagan; whilst Hooker's description of the shrub under the name of *C. serotina* answers also to specimens sent from the same quarter.

The two plants appear to be very distinct in every respect, except the names, which have thus been transposed and confused. The nomenclature may be satisfactorily arranged by calling the shrub *C. Virginiana* (Torrey and Gray), and the large tree *C. serotina* (DC.). At the same time it must be added, that Sir W. Hooker (Flor. Bor. Am.) expresses doubts as to their specific difference, remarking that the serratures and tufts of hair on the underside of the leaves are undoubtedly variable, and that in point of form of foliage it is not easy even to distinguish the American shrub from our *C. Padus*. The large tree, *C. serotina* (DC.), which is the species officinal in the United States' Pharmacopœia, on account of its bark, is also used as timber by the American cabinet-maker. Sir W. Hooker gives Canada as a doubtful station for it, but it is found in Canada West, where Dr. P. MacLagan saw one specimen cut down which was 80 feet high.

The bark, as found in the shops of the United States, is thus described by Wood and Bache:—It is in pieces of various sizes, more or less curved laterally, usually destitute of epidermis, of a lively reddish cinnamon colour, brittle and pulverizable, presenting a reddish gray fracture, and affording a fawn-coloured powder. When fresh it has the odour of peach leaves, and yields by distillation, according to the experiments of Dr. Procter, a volatile oil, conjoined with hydrocyanic acid; the same is got from cherry-laurel leaves. It contains also a bitter principle and tannin. The Americans use the bark recently dried, as it deteriorates by keeping.

The bark, as it was last year brought to the shops in Edinburgh, is in narrow strips, varying in length from a few inches to a foot and a half, with a smooth gray epidermis, which curls itself off in horizontal strips, a character which is very marked in *C. serotina* in its native woods. On pulling off the epidermis, a suberous layer of a greenish white colour and silky lustre is exposed. The inner bark is of a bright cinnamon-red, inclining to orange, and there are often found adhering to it portions of a very white albumen. This wood is tough, and not easily pulverized. It is bitter and very astringent to the taste. On inquiry as to the source from whence this bark, which was sent from London, was derived, it was stated to be the officinal American bark of British growth. Now, *C. serotina* is not a common tree in Britain. This bark is, from its appearance, not that of *C. Padus*, nor of the shrubby *C. Virginiana*, from which circumstances, as well as from its general aspect, Dr. MacLagan concludes that it is merely the bark of *C. avium*.

The druggists here, dissatisfied with this English bark, have got the officinal substance imported from America. It is now brought in 1 lb. packages, as made up in America; is in small fragments not more than an inch long, is free from epidermis, and otherwise corresponds with Wood and Bache's description.

Dr. Maclagan made various experiments with different samples of the English bark, to determine whether or not it would yield any hydrocyanic acid; but though he subjected four separate portions to distillation, he could not obtain from it the least trace of this active principle. It is obvious, therefore, that the bark of English growth wants one of the most important constituents of the American bark, and is comparatively of little value. Dr. Maclagan's trials of it in practice had not tended to raise it in his estimation. It did not appear to have any special advantage over other bitters of which there are plenty, and from the great quantity of altered tannin and extractive which is taken up in the infusion, it even appeared frequently to disagree with the stomach. From the American imported bark, however, Dr. Maclagan separated hydrocyanic acid in small quantity by distillation. It made a very bitter infusion, and deposited some tannin on cooling. Alcohol appears to take up more of the bitter, and water more of the astringent matters of these barks. Even the American bark, however, which is now in the best shops substituted for the English, does not appear to possess that combination of sedative and calmative action with tonic power, for which it is preferred in the United States, and did not appear to be so useful, and cannot be so uniform in quality, as a combination of some of our common bitters, such as colombo with hydrocyanic acid, a form of prescription which had proved very efficacious in his hands. In fact the want of calmative property had led to its being generally prescribed with hydrocyanic acid added to it, and thus it did not appear to Dr. Maclagan to have any special advantages.

The fact that the bark of the *C. serotina* yields hydrocyanated oil has been established by the experiments of Procter quoted above; that the bark of *C. Padus* yields hydrocyanic acid also has been long known. Dr. Maclagan had made some experiments with the fresh twigs of *C. Virginiana* from the Botanic Garden of Edinburgh, and found that it yielded hardly any volatile oil, not enough to render the distilled product milky, but it gave a certain amount of hydrocyanic acid.

From two ounces of fresh bark distilled with water, he obtained a distillate which gave 0·08 of real hydrocyanic acid; but the decoction contained little tannin, was barely bitter, and had rather a sweetish taste. It was obvious, therefore, that the bark of the shrubby *C. Virginiana* would be of little use as a medicine.

Dr. Maclagan likewise examined the bark of *C. Padus*. From two ounces of the fresh bark he got by distillation a fluid which had a distinct layer of oil on the surface, and contained 0·26 of real hydrocyanic acid, or more than three times the amount got from *C. Virginiana*. The decoction of *C. Padus* also was richer in tannin, and was strongly and agreeably bitter. Dr. Maclagan had not had

opportunity of examining the fresh bark of *C. avium* or of *C. serotina*, but from the examination of the English and American commercial barks, which he presumed to be derived from these trees respectively, and from the above examination of *C. Padus*, it appeared to him that if any such bark was to be used in this country at all, that of the last-named species would probably answer as well as any other.

Dr. MacLagan likewise exhibited specimens of, and made some remarks on, the following medicinal plants, which are in use in America, though little known in this country:—

Triosteum perfoliatum, Linn.—The bark of the root is cathartic, and in large doses emetic, and as such is employed in America under the name of Fever-root.

Phytolacca decandra, Willd.—Poke-weed. The root and berries are emeto-cathartic and somewhat narcotic, and have been used in America in chronic rheumatism. In many of its actions it appears to resemble mezereon.

Eupatorium perfoliatum, Linn.—Thoroughwort. The leaves are esteemed tonic and diaphoretic, and have been used with success in intermittent fever. It appears from the statements of Wood and Bache to have arrested intermittent fevers chiefly by acting as an emetic, and can hardly be looked upon as possessing the properties of an anti-periodic.

Arisæma atrorubens, Blume; *Arum triphyllum*, Willd.—Indian Turnip. The recent root is extremely acrid, but when dried becomes bland, and yields its starch readily, quite white and pure. The half-dried root has been used as a stimulant expectorant in chronic catarrh, and when mixed with sugar, as a stimulant application to sore mouths in children. The starch resembles under the microscope that of *Arum maculatum*, being in small grains of a rounded form, but frequently presenting a somewhat angular aspect.

Podophyllum peltatum, Linn.—May-apple, or Mandrake. The root is an efficient purgative, acting very like jalap, and applied to the same class of cases in which that drug is used. The leaves have the character of being somewhat narcotic, but the fruit, which is sometimes called Wild-lemon, is eaten with impunity.

Mr. M'Nab read the following list of the times of appearance in flower of plants in the open borders of the Botanic Garden, Edinburgh, from 15th February till 14th March, 1850, in continuation of a similar list presented at the February meeting:—

- | | |
|---|---|
| Feb. 15. <i>Hepatica triloba</i> , vars. | Feb. 22. <i>Daphne Mezereon</i> . |
| 16. <i>Crocus Susianus</i> (cloth of gold). | 22. <i>Knappia agrostidea</i> . |
| 16. <i>Corylus Avellana</i> (hazel). | 23. <i>Primula denticulata</i> . |
| 18. <i>Leucojum vernum</i> . | 23. <i>Vinca minor</i> . |
| 18. <i>Symplocarpus foetidus</i> . | 24. <i>Petasites vulgaris</i> . |
| 18. <i>Viola odorata</i> . | 25. <i>Daphne Laureola</i> . |
| 20. <i>Capsella Bursa-pastoris</i> . | 25. <i>Dondia Epipactis</i> . |
| 21. <i>Arabis albida</i> . | 25. <i>Potentilla Fragariastrum</i> . |
| 21. <i>Bellis perennis</i> . | 26. <i>Crocus sulphureus</i> , and other garden vars. |
| 21. <i>Lamium purpureum</i> . | 27. <i>Tussilago Farfara</i> . |

Feb. 28. Nordmannia cordifolia.	Mar. 11. Scilla bifolia, cærulea (13th of March).
Mar. 1. Hyoseyamus Scopolia.	11. Pulmonaria mollis.
1. Primula nivalis.	11. Vinca major.
2. Doronicum caucasicum.	12. Tussilago alba.
2. Tussilago nivea.	12. Sisyrinchium grandiflorum.
4. Narcissus pumila.	13. Hyoseyamus Physaloides.
5. Anemone Pulsatilla.	13. Cheiranthus Cheiri.
7. Asarum Europæum.	14. Draba aizoides.
8. Omphalodes verna.	14. Aponogeton distachyon (in open-air pond).
9. Iberis sempervirens.	14. Symphytum caucasicum.
11. Cardamine hirsuta.	14. Ribes sanguineum.
11. Erythronium Dens-Canis.	
11. Scilla bifolia, alba.	

Mr. Evans stated that he had made similar observations on the flowering of plants in the Experimental Garden. In a warm situation *Sisyrinchium grandiflorum* and *Primula denticulata* were in flower on the 19th of February. *Bellis perennis* flowered on the 25th of February, and the Apricot on the 1st of March.

Specimens of dye-woods were sent for exhibition by Michael Connal, Esq.

Mr. Stark exhibited specimens of *Leptothrix tinctoria* and *Chylocladia reflexa* from Mr. Ralfs; also of *Sphacelaria plumosa* in fructification, *S. scoparia* from Arran, and *S. filicina* from the county of Down, Ireland.

MISCELLANEOUS.

On the Pathology of the Silk-Worm (Bombyx Mori, L.). *Examination of the Blood.* By F. E. GUÉRIN-MENEVILLE.

THE author has directed his attention to that most terrible malady which attacks the silk-worm, and is known in the nurseries by the name of *Muscardine*. It depends upon a microscopic plant belonging to the group *Botrytis*, which develops itself in the worm whilst living, and destroys it at the very period at which it spins the precious cocoons which ought to repay all the care and expense bestowed upon the animal.

The blood of a healthy silk-worm examined as it leaves the body, exhibits under the microscope, globules analogous to those of the human blood; but these globules are developed and reproduced from each other during the entire course of the life of the animal, and pass through the following phases, which may be observed in the same drop of blood. At first there are minute globules exhibiting in their centre simply a single opaque point; the globule when grown larger presents a *nucleus* composed of several granules of equal size. At a third period, these granules become disaggregated and tend towards the circumference of the globule; finally, they push outwards the various points of its external envelope upon which they press; hence the circumference of the globule presents projections resembling buds which soon open and give passage to the granules which have produced them; these when once set free in the serum become surrounded by a transparent membrane, and form new globules in the first stage of development. These curious facts, which the author only admits

after numerous observations, and having verified them in several other species of insects, are still less astonishing than those which characterize the pathological state of the same blood.

The blood of the worms when affected with other maladies than muscardine, contains fewer globules in proportion to the proximity of the death of the animal. But the appearance of the blood explains the disappearance of the globules. At first, those found in it in small numbers are all mature, or have even already discharged their granules externally; whilst globules in progress of development are entirely absent, but in their place are observed corpuscles in every respect resembling the granules of the nucleus of the mature globules. These corpuscles, which are all alike, move with rapidity, although there appears to be no cause for their motion, which moreover presents all the characters of voluntary motion.

M. Guérin, by numerous observations which have been verified by other persons, has acquired the conviction that these corpuscles are the granules which have escaped from the nucleus of the globules existing in the blood. These granules under the influence of the morbid state have not been able to form new globules, and then enter upon a kind of independent vitality which begins the disorganization of the diseased individual by that of its nutritive fluid. We can now understand the absence of the globules in the earliest periods of their development, and the constantly greater diminution of the globules in proportion as the animal approaches its end; it is a source which flows off without renovation. M. Guérin-Meneville gives the name of *Hæmatozoides* to the animals thus developed in the diseased blood. He has also met with them in other insects; and what is still more curious, is that he has succeeded in producing them at pleasure in healthy insects, by causing them to endure hunger for some days; so that, at least in insects, depauperization of the blood from the action of debilitating causes of any kind is caused by the inaptitude of the existing nucleolar granules to form new ones. This result undoubtedly deserves great attention.

But muscardine has presented to M. Guérin some facts of a still more remarkable character. In it, whether the worm has acquired the disease naturally, or some sporules of *Botrytis bossiana* which produces muscardine have been placed upon its body with the point of a needle, even before the morbid condition is announced by any external signs, the blood begins to exhibit the hæmatozoids; they increase every hour, and intermixed with them very short navicular bodies are soon seen, but which speedily become developed, even under the mere influence of moisture into the thallus or root of the muscardic *Botrytis*. At this period of the disease, M. Guérin has seen one of the most curious phænomena in organic nature, and one which bears upon several long-debated questions; he has seen the *Hæmatozoides*, those animated corpuscles which originated from the nucleolar granules, gradually become transformed into the thallus of the *Botrytis*. They acquire a more elongated form, the motion still existing; then when they have acquired a further state of elongation, the motion ceases, and the animate matter is metamorphosed into vegetable matter, which however continues to grow more and more.

So that after the death of the muscardic worm, the blood is filled with the thallus in every stage of development. In the latter case, crystals of a perfectly definite form are mixed with the thallus; these are products of some chemical reaction, and are undoubtedly the cause of the rigidity of the dead body of the muscardic worm.

By means of abstractions of the circulating fluid, which are very easily effected, M. Guérin is able to satisfy himself of the state of health of silk-worms, or to predict to the silk-worm cultivator the invasion of such and such diseases; and this is useful, especially in muscardine; for by ceasing to feed those worms which are doomed to an inevitable death, an enormous quantity of mulberry-leaves are economized, and the pecuniary loss entailed by such accident is considerably diminished.

The reproduction of the globules of the blood appears to be quite new and of extreme importance in a physiological point of view. It explains very simply the unequal diameters of the globules of the blood of the Invertebrata, and directs us to researches in other species of this extensive group with a view of ascertaining the same facts, and to the Vertebrata themselves to find its analogies. In the latter, the perfect uniformity in the globules of the blood might *à priori* indicate a want of analogy; but, if real, we must first accurately determine it; if it be only apparent, we must discover the truth which is still unknown.

On the other hand, we must bear in mind, that in the Vertebrata, the nutritive fluid is met with in different states; the chyle, lymph, and blood. The blood is its ultimate expression, the terminal or perfect state; it is probably not in it therefore that we must seek for these phenomena of degeneration of the globules. Those of the lymph, which are colourless and smaller, have long been regarded as an earlier stage of them. By a coincidence which is at least remarkable in the frog, the triton, and the tortoise, where it has been possible to make observations upon the lymph, the size of the lymphatic globules pointed out by authors is exactly that of the nuclei of the globules of the blood in the same animal; the shape, certainly, differs, but the relation of size is constant. Lastly, there is a curious fact connected with this question: Schultz, who has observed the formation of the *area vasculosa* in the embryo of birds, states that the nucleus is the first part which appears; the vesicle being ultimately formed around it.—*Gazette des Hôpitaux*, Feb. 2, 1850.

BRITISH MUSEUM.

To the Editor of the Annals of Natural History.

SIR,—Having been in the habit of continually using the Natural History collection in the British Museum, never finding any difficulty, and knowing by experience that it is the most completely arranged, and far more easy of access than any other collection in the country, or on the continent, I was surprised to read in the Report of the British Museum Commissioners, the following words as the bases of all their observations on the Department:—

“Being aware from the Memorial presented to the First Lord of the Treasury on the 10th of March 1847, by a very numerous body of

the cultivators of natural history science, that a wide-spread dissatisfaction prevails among them *relative to the actual condition of and means of access to the vast and valuable materials in the Natural History Departments of the British Museum*, we have necessarily directed our attention to this subject of complaint." I was induced to look for the memorial, and you may well suppose my astonishment to find that it contains no such complaints, but was entirely devoted to another subject. The words of the memorial are as follows: "A strong feeling pervades the naturalists of our country that the promotion of the science of natural history is very inadequately provided for by the present constitution of the Trustees of the British Museum." The complaint here made was rectified by the election of Dr. Buckland as a Trustee.

If the other statements of the Commission are no more accurate than the above, their Report cannot be of much value, and the expenses incurred by their three years' occupation is a useless expenditure.—F.R.S.

ECHINOCACTUS EYRIESII.

Highgate, April 17, 1850.

MY DEAR SIR,—You will remember my calling your attention some time ago to the characters which are assumed by *Echinocactus Eyriesii*. The artificial divisions which have been made of the Cactaceæ have always seemed to me unsatisfactory. The point is one of some interest to those who conceive, as I confess that I do, that clearness and definiteness of principle in the characterization of genus and species is a matter of much importance to the progress of natural history. I think I can satisfy any reasonable person that *Echinocactus Eyriesii* cannot be separated from *Cereus*, if Dame Nature is to be taken as a guide instead of mere arbitrary fancy. I take *E. Eyriesii* alone now, because it seems to be regarded as typical of the genus, and because I have had the longest opportunities of observing it.

I suppose nobody will contend that the mere matter of the *time* which it takes for a plant (or anything else) to reach maturity and its characteristic form, is to fix the determination of genus. This may, when strongly marked, be well enough for a specific distinction, but it cannot, surely, yield a generic one. Else, on every principle of logic, each different kind of *Cereus* must make a different genus. If two plants, belonging to the same family, and in the characters of whose flowers no essential distinction can be pointed out, assume, when arrived at mature age, a tendency to a similar habit, it seems to me that we get only into confusion, and make all classification mere moonshine, if we do not put them into the same *genus*.

Now to my friend *Echinocactus Eyriesii*. And I call it my friend, because, though not by any means a frequent denizen of the greenhouse, I am sure it ought to be so, if purity, elegance, and fragrance in a flower can give a claim. The gardeners pretend it is a shy bloomer. That must be owing to bad management. I do not know any cactus which is a freer bloomer. I have never passed a year without a constant succession, on the same plant, of its exquisite and delicately fragrant flowers. I have several plants of it. One of

these I have had for more than ten years. It must be thirteen years old, from my observation of the rate of growing. At three years old it was, according to the received descriptions, "*subglobose*," &c. But with its growth, it has altogether lost this character. And, while the flowers are identical in general characters with those of the *Cereus*,—very much more identical in detail with many species of the *Cereus* than those of different received species of *Cereus* are with one another,—it is quite impossible to separate the plant itself, in its general habit, from any characters taken from a general survey of the *Cereus*. The plant in question stands beside a specimen of *Cereus* whose flower that of the *Echinocactus* very nearly resembles, and which is remarkably full-grown and stout. Both plants grow tall and straight. Both have deep straight ribs. And, in both, the tubercles are arranged, with reference to one another on the adjoining ribs, in a regular figure, the quincuncial,—a matter which will, I think, be remarked in all the numerously ribbed species of *Cereus*, and a similar *character* of regular relative arrangement in those which have only three or four ribs. The *Echinocactus* is now nearly a foot high. It has continually, and regularly, grown in height, but does not get any broader.

I could enlarge on some other points of character; but this letter has already become longer than I intended. I will only add, that young plants sometimes run into the long thin form of so many of the *Cereus*. I have had young shoots of *Echinocactus* which could not be distinguished from young shoots of even *Cereus flagelliformis*;—which will be admitted to be about as extreme a comparison as could be made.

Thinking that any observations which can tend to the elucidation, or *fixation* (if I may say so), of the important and interesting question of *What is a Genus?* cannot be wholly useless, I place the above very much at your service.

I am, my dear Sir, very truly yours,

W. Francis, Ph.D.

J. TOULMIN SMITH.

CAUSE OF THE POTATO DISEASE.

The precise cause of the potato disease is still unknown; but we are able at least to eliminate certain presumed causes, and to prove where the disease begins, and how it reaches the tubers. It is pretty generally admitted at present that the parts of the plant exposed to the air are first attacked, and that their diseased state precedes that of the tubers, and probably causes it. The following is a rather curious proof that such is the case. M. de Gheldere of Thourout in Belgium grafted some tobacco plants upon potatoes, according to Tschudy's method. Success was probable, as the *Nicotiana* and *Solanum* belong to the same family. The grafts did not merely take, a fact of itself very interesting, but the plants happening to be in a field of potatoes entirely attacked by the disease, the grafted stocks alone remained exempt. If the tubers were sound in this case, it can only be attributed to the presence of the leaves of tobacco not liable to the disease, instead of leaves of the potato itself. The fact

is recorded in M. Ch. Morren's Report on the Exhibition of the products of Belgian agriculture and horticulture, 1847.—*Bibliothèque Universelle*, Feb. 1850.

On the Nature of the Gregarinæ. By Dr. F. STEIN.

The author has raised the number of species of insects in which *Gregarinæ* occur to 68. Previously it was known only of 29. With the addition of the Myriapoda, Crustacea and Annelides (the *Lumbrici* contain some in their male organs; Henle), the number amounts to 80. They are for the majority voracious and carnivorous animals; at all events they never feed upon fresh vegetable matter. This distribution of the *Gregarinæ* in species whose kind of life is so exclusive evidently proves that their germs are introduced with the food.

The body of the *Gregarinæ* is an ovoid, fusiform or cylindrical sac, everywhere closed, without any trace of mouth or anus. In some species the body is simple, but most frequently it is separated into two parts. The anterior portion forms a hemispherical or conical segment, separated from the remainder by a strangulation. A vertical septum corresponds to this constriction, and thus divides the interior cavity into two portions. This septum had not been previously observed. In other species the body is divided into three cavities by two strangulations and two corresponding internal septa.

In accordance with these differences of organization, the author separates the *Gregarinæ* into three natural families:—

1. The *Monocystideæ* or simple *Gregarinæ*, without strangulation and without internal septum.

2. The *Gregarinariæ*, or ordinary *Gregarinæ* with the body divided into two parts.

3. The *Didimophydeæ*, or *Gregarinæ* whose body is divided into three portions, as if it resulted from the adhesion of two individuals, one from each of the preceding families.

The envelope of the *Gregarinæ* consists of a hyaline, transparent, smooth and elastic membrane. Sometimes the outer surface is prolonged into immoveable filaments or into vibratile cilia (Henle found the latter to be the case in the *Gregarinæ* from the *Lumbrici*). The interior presents not a trace of organization; it is filled with a liquid, probably albuminous, in which a considerable number of globules float, which the author considers to be globules of fat. The young individuals contain a less number, and are consequently more transparent. Dr. Stein confirms the presence of a nucleus placed freely in the contents of the *Gregarinæ*. It is always simple in the *Monocystideæ* and the *Gregarinariæ*; one species of the third family exhibited two, another contained but one. Although the reproduction of these singular organisms is still quite obscure, several facts appear to throw some light upon the subject. One of the most important is the following observation of Von Siebold.

The thin intestines of a dipterous larva (*Sciara nitidicollis*) contain, along with numerous *Gregarinæ* (*G. caudata*), a large number of round vesicles filled with innumerable minute bodies of a turnip shape, called Navicellæ by Von Siebold. They are composed of a soft nucleus, and of a hard and transparent envelope. Henle again

met with them in the genital organs of a *Lumbricus*, accompanied by true *Gregarinæ*. These two facts evidently demonstrate a relation between the Navicellæ and the development of the *Gregarinæ*. Numerous observations made by Dr. Stein on the development of the Navicellæ in the *Lumbricus*, prove that these are only stages of metamorphosis of the *Gregarinæ*. After having observed some transitions between the genus *Zygocystis* (a *Gregarina* where two individuals adhere by the anterior portion of their body) and the cysts in which the Navicellæ are developed, Dr. Stein compares their formation to the reproduction by conjugation observed in some *Confervæ*. Observations made upon other *Gregarinæ* inhabiting the intestinal canal of insects appear to confirm this view. It would thence result that two individuals unite at first by juxtaposition. In these adult pairs each individual assumes an oval shape. The interior septum separating the cavity of the body into two portions is re-absorbed; the two individuals then appear like two hemispheres pressed one against the other; they then secrete a gelatinous liquid, which solidifies, enveloping the two. Lastly, the particular membrane of each individual is re-absorbed, and their contents unite into a single granular sphere, which is gradually converted into Navicellæ. These bodies, called germinating granules by Dr. Stein, are frequently met with in the excrements of different insects, either free from their cysts or still contained in their envelopes (for instance in *Tenebrio molitor*). From thence they arrive with the food in the intestinal canal of other individuals, where on their development they give rise to *Gregarinæ*.—*Muller's Archiv and Bibl. Univ.*, August 1849.

WAY IN WHICH TOADS SHED THEIR SKINS.

I have a small house under my care for growing cucumbers. There is a bed in the middle of it, and the soil is about 3 feet high from the ground (*i. e.* to the top of the hills where the plants are in). A person therefore standing in the house can examine an object placed on the hill with ease. Last Saturday, about 7 o'clock A.M., I uncovered the house, and went in to see that all was right, when to my surprise I saw my pet companion, a fine toad, apparently in the agonies of death. It was seated at the end of the ridge or hill of soil; its mouth or rather under-jaw opening every few seconds (the top jaw did not move), the eyes shut, and the body violently convulsed each time the jaw opened, and with each convulsion of the body the right fore-foot was raised to the head. I placed myself in front of it, and perceived that it was drawing something into its mouth each time the jaw moved; at that instant the right eye opened, it then inflated the body on the left side and drew in the right, placing at the same time the left fore-foot on the head behind the eye and drawing it down to the mouth; it then appeared to hold its foot in the mouth for about a second, when it drew it out, and I distinctly saw the three points of skin that came off its toes outside its lips till the next opening of the jaw, when they were drawn into the mouth. When it drew its foot over its left eye (which before was shut), it broke out as bright as ever. Some folds of the skin adhered to the left leg, but by two or three motions of the jaw they were

gone, and in about a minute the skin was drawn off the lips—the toad had eaten its own skin, and there it stood with its new covering as bright as if it had been fresh varnished. I endeavoured to touch it, to feel if it was clammy, but the creature gave a vigorous jump, and the soil adhered to its legs. I looked at it in an hour afterwards; it had then begun to resume its dingy brown colour. The time it took to get off its head-dress was only a few minutes. It appeared to me that each time its jaw opened it drew the skin forward, while it distended the body on the side to be uncovered. W. TURNER.—*Gardeners' Chronicle*, Mar. 1850.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1850.

Chiswick.—March 1. Hazy: very fine: overcast. 2. Densely overcast. 3. Cloudy. 4. Cloudy: clear and frosty at night. 5. Frosty: fine: cloudy. 6, 7. Foggy: fine: clear. 8. Hazy. 9. Slight fog: fine: clear. 10. Very fine. 11. Clear and fine: frosty. 12. Frosty: very fine: clear. 13. Frosty, with slight fog: very fine. 14. Overcast. 15. Overcast: clear, with sharp frost at night. 16. Frosty: overcast: clear. 17. Frosty: cloudy: sunshine occasionally: clear and frosty. 18. Frosty and fine. 19, 20. Cloudy. 21. Cloudy and cold: clear and frosty. 22. Hoar-frost: cloudy. 23. Heavy clouds: sleet-showers. 24. Slight fall of snow-flakes: severe frost at night. 25. Clear and frosty: cloudy: clear: frosty. 26. Overcast. 27. Foggy: slight haze: frosty. 28. Slight haze: bright sun with dry cold air: clear and frosty. 29. Foggy: cloudy: clear. 30, 31. Overcast.

Mean temperature of the month 37°·71

Mean temperature of March 1849 41 ·56

Mean temperature of March for the last twenty-three years 42 ·81

Average amount of rain in March 1·36 inch.

Boston.—March 1, 2. Cloudy. 3. Fine: rain P.M. 4. Cloudy. 5—7. Fine. 8, 9. Cloudy. 10. Fine. 11. Cloudy. 12, 13. Fine. 14, 15. Cloudy. 16. Cloudy: rain A.M. 17, 18. Fine. 19. Cloudy: rain A.M. 20. Cloudy. 21. Fine. 22. Cloudy. 23. Fine: rain early A.M. 24. Cloudy: snow A.M. and P.M. 25. Cloudy. 26, 27. Fine. 28. Fine: rain A.M. 29, 30. Fine. 31. Cloudy: rain A.M.

Applegarth Manse, Dumfries-shire.—March 1. Fine: a shower early A.M. 2. Slight shower during night: thick P.M. 3. Rain heavy A.M.: cleared. 4. Frost: clear and fine. 5. Moist all day. 6. Mild and growing: moist. 7. Fine spring day. 8. Still finer: clear and warm. 9. Dull and moist: slight shower. 10. Clear and fine: slight shower. 11. Frost: clear and bright. 12. Frost: cloudy. 13. Frost, not so severe. 14, 15. Mild: cloudy: no frost. 16. East wind: dull. 17. Dull: raw: cold: shower. 18. Dull and cloudy, but mild. 19. Dull A.M.: cleared: rain P.M. 20. Very fine: slight drizzle. 21. Fine, though raw A.M. 22. Dry, but cloudy: stormy P.M. 23. Frost: snow: wind. 24. Hard frost: snow: calm P.M. 25. Frost very hard: thermometer 21½°. 26. Frost slight: heavy snow A.M. 27. Frost severe: snow again. 28. Frost still harder: clear. 29. Frost still. 30. Frost moderate: hail: rain P.M. 31. Rain: cloudy and foggy P.M.

Mean temperature of the month 40°·3

Mean temperature of March 1849 41 ·8

Mean temperature of March for the last twenty-eight years 39 ·6

Average rain in March for twenty-three years 2·35 inches.

Sandwick Manse, Orkney.—March 1. Showers: drops. 2. Drizzle. 3. Cloudy: showers. 4. Snow: cloudy. 5. Damp: rain. 6. Drizzle: cloudy. 7. Damp. 8. Fine: drizzle. 9. Cloudy: showers. 10. Sleet: aurora. 11. Bright: clear: aurora. 12. Drizzle. 13. Damp: drizzle. 14. Drizzle: damp. 15. Bright: damp. 16. Cloudy. 17. Drops: showers. 18. Hazy: cloudy. 19. Cloudy. 20. Bright: drops. 21. Cloudy: drops. 22. Showers: snow-showers. 23. Hail-showers: snow-showers. 24. Snow-drift: snow-showers. 25. Snow-showers: large halo. 26. Snow-showers. 27, 28. Bright: snow-showers. 29. Bright: clear. 30. Cloudy. 31. Drops: cloudy.

Days of Month.	Barometer.				Thermometer.				Wind.			Rain.						
	Chiswick.		Boston. 8 ^h a.m.	Dumfries-shire. 9 a.m.	Orkney, Sandwick. 9 ^h a.m.	Orkney, Sandwick. 8 ^h p.m.	Chiswick.		Dumfries-shire. 8 ^h a.m.	Max.	Min.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
	Max.	Min.					Max.	Min.										
1850.																		
March.																		
1.	30.332	30.209	29.86	29.92	30.00	29.68	29.82	38	41	51 ¹ / ₂	42	45	45 ¹ / ₂	sw.	swsw.	.....	.....	.....
2.	30.290	30.088	29.80	29.94	29.70	29.58	29.43	53	48	48	42	48 ¹ / ₂	sw.	sw.	.....	.....	.....	.....
3.	29.878	29.661	29.37	29.40	29.48	29.34	29.63	54	33	46	45	45	s.	ssw.	.....	.....	.....	.....
4.	30.343	29.909	29.67	29.99	30.18	30.03	30.07	44	20	40	42	30	n.	n.	.....	.....	.....	.....
5.	30.536	30.526	30.06	30.20	30.28	29.89	29.95	26	35	50	35	47	w.	ws.	.....	.....	.....	.....
6.	30.621	30.547	30.10	30.30	30.33	29.96	30.12	56	27	43	51	37	sw.	wnw.	.....	.....	.....	.....
7.	30.630	30.470	30.03	30.37	30.32	30.17	30.16	56	31	42	53	46	sw.	w.	.....	.....	.....	.....
8.	30.423	30.322	30.00	30.26	30.19	30.25	30.23	47	38	44	55	40	ne.	nw-se	.....	.....	.....	.....
9.	30.237	30.178	29.85	30.03	29.98	29.88	29.70	50	27	43	46	41	e.	sw.	.....	.....	.....	.....
10.	30.258	30.243	29.85	30.03	29.98	29.74	30.15	54	28	40	50	38	nw.	w.	.....	.....	.....	.....
11.	30.467	30.414	30.04	30.38	30.40	30.40	30.38	48	20	36	48	29	ne.	nw.	.....	.....	.....	.....
12.	30.554	30.549	30.22	30.44	30.44	30.35	30.38	57	21	33	48	29	n.	n.	.....	.....	.....	.....
13.	30.528	30.454	30.12	30.40	30.41	30.36	30.47	51	30	33	53	32	nw.	nw-w	.....	.....	.....	.....
14.	30.475	30.458	30.06	30.42	30.41	30.51	30.51	47	34	45	52	41	ne.	s-e.	.....	.....	.....	.....
15.	30.449	30.399	30.07	30.40	30.32	30.46	30.40	47	18	41	52	39	ne.	s.-sw.	.....	.....	.....	.....
16.	30.275	30.142	29.88	30.25	30.22	30.36	30.32	48	23	41	49	41	ne.	nne.	.....	.....	.....	.....
17.	30.303	30.301	30.00	30.20	30.21	30.23	30.24	48	17	33	43	35	ne.	sw.	.....	.....	.....	.....
18.	30.286	30.197	29.87	30.20	30.13	30.23	30.20	44	24	33	48	31	ne.	sw.	.....	.....	.....	.....
19.	30.131	30.111	29.77	30.08	30.10	30.17	30.22	45	34	45	50	41	ne.	e.	.....	.....	.....	.....
20.	30.194	30.162	29.82	30.13	30.10	30.20	30.28	45	33	41	50	36	ne.	n.	.....	.....	.....	.....
21.	30.224	30.162	29.77	30.19	30.20	30.29	30.14	44	19	41	49	36	n.	nne.	.....	.....	.....	.....
22.	30.214	29.784	29.75	29.98	29.59	29.78	29.59	49	30	38	48	37	w.	n.	.....	.....	.....	.....
23.	29.529	29.504	29.20	29.48	29.51	29.45	29.64	44	27	34	47	28 ¹ / ₂	n.	n.	.....	.....	.....	.....
24.	29.692	29.492	29.22	29.63	29.70	29.76	29.79	42	22	32	37	29	nw.	n.	.....	.....	.....	.....
25.	29.769	29.736	29.45	29.68	29.54	29.38	29.70	42	14	29	40	21 ¹ / ₂	sw.	e.	.....	.....	.....	.....
26.	29.791	29.767	29.50	29.59	29.70	29.77	29.83	42	19	23	41	35	sw.	nw.	.....	.....	.....	.....
27.	29.937	29.710	29.58	29.76	29.82	29.87	29.95	44	16	26 ⁵ / ₈	42	22	e.	w.	.....	.....	.....	.....
28.	30.106	30.042	29.70	29.92	29.95	30.00	30.03	49	16	27	43	20	w.	ne.	.....	.....	.....	.....
29.	30.104	30.008	29.82	29.92	29.85	30.01	29.99	49	29	31	48	26 ³ / ₈	se.	ne.	.....	.....	.....	.....
30.	29.935	29.744	29.68	29.73	29.56	29.86	29.68	52	37	41	42	35	se.	se.	.....	.....	.....	.....
31.	29.751	29.737	29.40	29.43	29.50	29.54	29.58	55	33	41	50	36 ³ / ₈	se.	s.	.....	.....	.....	.....
Mean.	30.202	30.097	29.79	30.021	30.010	29.983	30.018	48.74	37.6	47.4	34.5	42.33			0.13	0.59	0.74	2.43

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 30. JUNE 1850.

XXXVII.—*Notes on an Examination of Lamarck's species of Fossil Terebratulæ* *. By THOMAS DAVIDSON, Esq., Member of the Geol. Soc. of France. Illustrated by figures of all the species drawn from the original specimens.

THE natural history of the invertebrated animals by the celebrated Chevalier de Lamarck is a work so generally consulted by all naturalists that it is unnecessary here to allude to its scientific value. Some parts however are not so clear as might be desired, owing to the state of science at that period, and especially from the want of figures illustrative of the text, so necessary an appendix to all specific descriptions.

The fossil *Terebratulæ* especially required some investigation, and on the suggestion of Mr. Morris, who had previously examined the Lamarckian species, and other palæontologists, I determined to visit Paris in February last, and endeavour to obtain the loan of all the typical specimens described in Lamarck's volume and preserved in the collections of that metropolis.

Lamarck having had the misfortune of losing his sight, without the remotest hope of regaining it, during the publication of the sixth volume of his '*Animaux sans Vertèbres* †,' M. Valenciennes, at his suggestion, took upon himself the determination of the species of the genus *Terebratula* that he was able to see in the Paris collections: so that it is in reality to M. Valenciennes that science is indebted for the publication of that part of the work relating to the Brachiopoda. On expressing to Prof. Milne-Edwards and Valenciennes my wish to investigate those specimens of Lamarck's in the museum of the Garden of Plants, they at once in the most liberal manner (after having obtained the consent of the Executive Council of that establishment) lent me the specimens to bring to England in order that I might more carefully examine and illustrate them, and I here publicly express

* *Animaux sans Vertèbres*, vi. Feb. and June 1819.
Ann. & Mag. N. Hist. Ser. 2. Vol. v.

† *Ib.* p. 244.
28

my sincere thanks to those gentlemen of the Garden of Plants for the great confidence they reposed in me, and for the unlimited assistance they have always shown to those who take an interest in the study of science.

All the species described were not however to be found in the collection of the Garden of Plants; the greater number belonged to Lamarck's private collection, which became at his death the property of the Prince Massena, who sold them to M. le Baron Benjamin Delessert, and which now form part of his extensive and celebrated museum. M. Chenu, Curator of that Museum, in the most liberal manner placed at my disposal the remaining type specimens of Lamarck's collection. The specimens from the Garden of Plants are all ticketed by M. Valenciennes, the original describer; all those in B. Delessert's collection are labeled by Lamarck himself. M. Valenciennes has also, in the kindest possible manner, given me all the information in his power relative to some of the species which had presented any difficulty.

The original monograph of Fossil Terebratulæ, published thirty years ago (1819), was one of the first works written by the justly celebrated Valenciennes, and appeared at a time when little was known on the subject, and it is but justice that those species then established should be retained in the nomenclature where no objections exist. At that period authors were not in the habit, or rather did not feel so much the importance, of giving any reference to locality or strata; they simply contented themselves with a short Latin description of the outer form of the object under examination, so that with very few exceptions there exist no positive data as to the locality or geological position of the specimens in Lamarck's work. There is also some difficulty in a few cases of defining which were Lamarck's real types, as several specimens of different species are sometimes placed on one tablet, the description of which is adapted to more than one form; and lastly, it is possible that some of the specimens now in B. Delessert's hands may have been displaced while in the possession of Prince Massena. I have however compared as carefully as possible the specimens with the descriptions, and by the kind assistance of M. Valenciennes (where doubts existed) am able to lay before the public the figures of each species drawn from the types on which they were established. I must however add, that in some few cases the specimens belonging to Lamarck's collection were in bad condition, which I have restored in the figures from well-preserved specimens of the identical species in my own collection, in order to prevent misconceptions as to the shells intended as types. I have also thought it advisable in the text and in the plates to preserve the same order and numbers as used in Lamarck's sixth volume (1819); and in order to keep

this report as short as possible, I have simply added a few observations after each Latin description of Lamarck or Valenciennes.

In 1836 M. Deshayes published the 7th volume of his new edition of Lamarck's work, to which he annexed numerous species and notes, but did not materially increase our knowledge of the fossil species described in the edition of 1819, from not having had the advantage of examining and comparing the specimens in the original collection; there are however some useful notes and references which may be consulted with advantage.

The following is the order in which Lamarck's species are described in the 6th volume of the 'Animaux sans Vertèbres.' As the recent species have been often figured, it will simply be necessary to give the list:—

1. *Terebratula vitrea*, Lamarck (Linn. sp.).
2. ————— *dilatata*, Lamk.
3. ————— *pisum*, Lamk.
4. ————— *globosa*, Lamk.
5. ————— *rotundata*, Lamk.
6. ————— *flavescens*, Lamk.
7. ————— *dentata*, Lamk.
8. ————— *dorsata*, Lamk.
9. ————— *sanguinea*, Lamk.
10. ————— *Caput serpentis*, Lamk. (Linn. sp.).
11. ————— *truncata*, Lamk. (Linn. sp.).
12. ————— *psittacea*, Lamk. (Linn. sp.).

FOSSIL SPECIES.

13. *Terebratula subundata* (Sow. M. C. tab. 15. fig. 7).

14. *Terebratula carnea* (Sow. M. C. tab. 15. fig. 5, 6).

Obs. These two species are not to be seen in Lamarck's collection.

15. *Terebratula depressa*, Val. in Lamarck. Pl. XIII. fig. 15.

T. testa oblonga, transversim dilatata, supra coarctata et obtusa, striis concentricis lævibus: nate producta non incurva: foramine magno.

Var. b. testa minore: nate breviori.

Obs. This species is perfectly characterized and found in the Tourtia beds of Tournay and Montignies-sur-Roc in Belgium, whence Lamarck's specimens came; it is strange however how little it was known, since M. le Vicomte D'Archiac, in his "Rapport sur les Fossiles du Tourtia," Mémoires de la Soc. Géol. de France, vol. ii. 2nd series, p. 313. pl. 17. fig. 2 *a, b, c, d*, 3–10, 1847, believed it new, and gave to it the name of *Terebratula Nerviensis*, which is a synonym: in the Quarterly Journal of the

Geol. Soc., Nov. 1846, it was attributed to *Terebratula ovalis*, Lamk., by mistake. Lamarck's var. *b.* does not belong to the same species or epoch; it is a young specimen of some oolitic species, and is stated to come from Saturnin near Domfront, dép. de la Sarthe.

Both the species and variety may be seen in B. Delessert's collection, and I may here state that every time I mention B. Delessert's collection, I mean that part belonging to Lamarck's series.

16. *Terebratula ovalis*, Val. in Lamk. Pl. XIII. fig. 16.

T. testa ovali, transversim et superne dilatata, striis concentricis lævibus: nate incurva.

Obs. This species is quite distinct from *Terebratula depressa*, and is from the white jura or coral rag of Wurtemberg. Mr. Waterhouse showed me several young specimens referable to this species in the collection of the British Museum. In B. Delessert's collection.

17. *Terebratula numismalis*, Val. in Lamk. Pl. XIII. fig. 17.

T. testa subrotunda, lævi, utraque valva superne sinu instructa: striis concentricis remotis: nate brevi: foramine minimo.

Obs. This species is well known, has often been described and figured, and requires therefore no further remarks, except that I could not find the type specimen in the Paris collections; but as reference is made to tab. 240. fig. 1 *a, b*, of the 'Encyclopédie Méthodique' by Lamarck, no doubts can exist. I have therefore figured here a magnificent specimen of the species from the liasic beds of Normandy belonging to M. Deslongchamps. *Ter. Cor*, No. 22, is merely a bilobate variety of this species.

18. *Terebratula umbonella*, Val. in Lamk. Pl. XIII. fig. 18.

T. testa elongata turgida, transversim compressa, supra obtusa, lævi: umbonibus pre-elevatis: nate incurva.

Obs. This species has a strong resemblance to *Terebratula lagenalis*, Schloth., 1820; one specimen shows the deltidial area, while in others the umbo of the ventral valve touches the beak; this is visible in our English specimens of *lagenalis*; it was figured in the 'Encyclopédie Méthodique,' pl. 240. fig. 3, but the characters of the species are not well represented. Six specimens are to be seen in B. Delessert's collection; and on a ticket written by M. Menard we find, "de Montigny, commune de Mont-Bizol sur la Sarthe, à trois lieues de Mans."

19. *Terebratula digona* (Sow. M. C. tab. 96. fig. 1. 5).

Obs. Several specimens are to be seen in B. Delessert's collection.

20. *Terebratula deltoidea*, Val. in Lamk. Pl. XIII. fig. 20.

T. testa compressa, transversim dilatata, triangulari, lævi, margine supero recto in medio sinuato.

Obs. This species was first figured and described by Fabio Colonna (1616) under the name of *Anomya diphya*, which name must be preserved. It subsequently received the following names: *Terebratula triquetra* in 1811 from Parkinson, *Ter. deltoidea* in 1819 from Lamarck, and *Ter. Antinomya* from Sig. Catullo. It is only within the last few years that geologists are agreed as to its geological position, which is the middle jurassic beds or *Terrain Callovien* of M. D'Orbigny (Italy and Porte-de-France near Grenoble): it differs from a similarly shaped shell described under the name of *Terebratula diphya* by M. le Baron D'Hombre Firmas, said to be from the Neocomian beds of Gigondas; and subsequently distinguished and figured by M. D'Orbigny under the name of *Terebratula diphoides*, 'Pal. Franç. Ter. Crétacés,' vol. iv. p. 87. pl. 509. The specimen in B. Delessert's collection belongs to the *Ter. diphya*, and would appear to have come from Italy. Figures are given in the 'Encycl. Méthodique.' This species has also received several other names.

21. *Terebratula Triangulus*, Val. in Lamk. Pl. XIII. fig. 21.

T. testa longitudinaliter elongata, triangulari, lævi: valva inferiore in superiorem reflexa, ad marginem sulco impresso.

Obs. M. D'Orbigny in his 'Prodrome' adopts the name *Terebratula triquetra*, Parkinson, 'Organic Remains,' vol. iii. pl. 16. fig. 8 (1811), a name given likewise by that author to *Terebratula diphya*, and both belong to the same beds and localities. Subsequently Sig. Catullo named it *Terebratula mutica*, but which, with Lamarck's, must be added to the synonyms.

22. *Terebratula Cor*, Val. in Lamk. Pl. XV. fig. 22.

T. testa cordiformi subglobosa, sinu valde exarata, striis tenerrimis decussatis.

Obs. No reference to figure, locality or age is given by Lamarck, so that much doubt rested on this species until M. Valenciennes found in the collection of the Garden of Plants the type specimen, which he forwarded to me, and of which an exact figure will be found in Plate XV. As will be seen at once, this species is the same as M. Valenciennes' and Lamarck's *Terebratula numismalis*, No. 17. One of the two must be placed among the synonyms; the specimen which served as the type has exactly the form of a heart, but this is only an accidental shape of the species. It belongs to the lias, and is abundantly found at Vieux Pont in Normandy, and in many other places.

23. *Terebratula birostris*, Val. in Lamk. Pl. XIII. fig. 23.

T. testa subglobosa, subrotunda, lævi, superne subcoarctata, medio sinuata, ad sinum duobus angulis : margine non plicato.

Obs. Only one crushed specimen is to be seen in B. Delessert's collection, without any other indication but the name written by Lamarck. On minute comparisons I believe it is the same as *Terebratula grandis* of Blumenbach, a tertiary shell from Malta : the specimen however is in such bad condition that one can hardly judge of its exact form.

24. *Terebratula Ampulla* (Brocchi, Conchologia Fossile Milan, tab. 10. fig. 5).

Obs. A very fine specimen of this species exists in the collection of the museum of the Garden of Plants, and a similar one in that of the British Museum ; it is a tertiary species found at San Geminiano in the Piacentino, &c. The loop was short, as can be seen in a very fine specimen in M. Deshayes' collection.

25. *Terebratula carinata*, Val. in Lamk. Pl. XIII. fig. 25.

T. testa subquadrangulæri lævi ; valva inferiore subcomplanata, superiore diedra, medio carinata.

Obs. A few years ago Mr. Morris called attention to this species, which was confounded with Sowerby's *Terebratula resupinata*, M. C. tab. 150. fig. 3, 4, 1818, and which hitherto appears principally characteristic of the liassic period. The *Ter. carinata* of Lamarck has not that I am aware been found in the lias beds, but is an oolitic species distinct by its foramen, and of a much flatter and more elongated form. There are many varieties in the *resupinata* group, which I hope to figure and describe shortly in my monograph of British Fossil Brachiopoda for the Palæontographical Society. I was not able to find the type specimen of this species in Paris, and have therefore figured a well-characterized specimen from the oolite beds near Caen.

26. *Terebratula concava*, Val. in Lamk. Pl. XIII. fig. 16.

T. testa parva : valva inferiore plana, superiore majore concava striis concentricis.

Obs. Lamarck states this species to be small, white, with a ventral valve flattened, and a very convex dorsal one : locality Meudon. No other cretaceous species from that locality would answer the above description except *Magas pumilus* of Sow. In Lamarck's collection however we find a small shell which answers the above description, except in colour, ticketed by Lamarck *Ter. pumila*, and the only specimen that I could find ; but it belongs to quite another species, being the well-known Oxford clay *Tere-*

bratula impressa. The description however cannot have been drawn up from that shell, or Lamarck would not have stated it to be white. I have given the figure of the *Terebratula impressa* marked *Ter. concava* from B. Delessert's collection, as well as a figure of *Magas pumilus* from Meudon marked fig. M. It is therefore evident that Lamarck's species must be cancelled from the nomenclature.

27. *Terebratula semiglobosa* (Sow. M. C. tab. 15. fig. 9).

Obs. Lamarck does not seem to have known Sowerby's species, as none of the three specimens marked such in B. Delessert's collection belong to it, being specimens of *Ter. ornithocephala*, and a variety of *Ter. globata*, Sow. The true species is cretaceous.

28. *Terebratula punctata* (Sow. M. C. pl. 15. fig. 4).

Obs. Several specimens are to be seen in M. Delessert's collection, none of which are Sowerby's type: Lamarck's specimens belong to *Ter. numismalis*, *indentata* and *vulgaris*. Sowerby's species is a well-characterized liassic shell.

29. *Terebratula phaseolina*, Val. in Lamk. Pl. XIII. fig. 29.

T. testa parva, subcompressa, rotunda, alba, striis concentricis, margine supero sub-biplicato: nate brevi, non producta.

Obs. M. D'Orbigny seems to consider Lamarck's *Terebratula phaseolina* to be Brocchi's *Anomya biplicata*, Pal. Franç. Ter. Crétacés, vol. iv. p. 95. pl. 511. fig. 9, 15. After comparing the numerous specimens of *Ter. phaseolina* in M. le B. Delessert's collection with the figures given by Brocchi, 'Couchologia Fossile,' p. 469. pl. 10. fig. 8, 1814, I cannot believe them to be the same shell as *Ter. phaseolina*; and since even M. D'Orbigny places a point of interrogation behind his synonym of Brocchi, it is evident he was not certain of the identity. I therefore do not see why Lamarck's well-known species should make place for Brocchi's uncertain one; which has no indication of locality or deposit. It seems also strange that M. D'Orbigny should everywhere write Lamarck's *Ter. phaseolina*, "*phascolina*," and whilst he rejects it in page 95, adopts it in page 109 of the 'Pal. Franç. Ter. Crétacés.'

30. *Terebratula ovata* (Sow. M. C. pl. 15. fig. 3).

Obs. As M. Deshayes observes, in his new ed. of Lamarck, the specimens in the museum of the Garden of Plants do not belong to Sowerby's type. M. Deshayes believes them to resemble *Ter. lata* of Sow., but they do not represent that species.

31. *Terebratula biplicata* (Sow. M. C. pl. 90. fig. 1, 5).

Obs. We find a number of specimens under this name in La-

marck's collection at B. Delessert's, as well as in the museum of the Garden of Plants, none of which however belong to Sowerby's type, but are referable to several distinct forms from various deposits of different ages. Thus for example, those in the Garden of Plants, as well as one in B. Delessert's cabinet, are oolitic; others belong to the Neocomian beds, such as those shells figured and described by M. D'Orbigny in vol. iv. p. 75. pl. 506. of the 'Pal. Franç.' under the name of *Terebratula prælonga*, Sowerby: but M. D'Orbigny is mistaken as to his identification of this shell with the ones described under that name by Mr. Sowerby. Besides these, we find two specimens which are probably *Terebratula Sella*, and as M. Deshayes justly observes in his new edit. of Lamarck, a great number of smooth *Terebratulas* with two plaits have been called *Ter. biplicata*, but which are quite distinct from Sowerby's type, which belongs to the gault of Folkestone and Cambridge.

32. *Terebratula bisinuata*, Val. in Lamk. Pl. XIII. fig. 32.

T. testa subrotunda, subdepressa, antiquata, fragili, lævi, superne biplicata: nate producta non incurva.

Obs. This species belongs to the tertiary beds of the Parisian basin, well figured and described by M. Deshayes, Coq. Foss. des Env. de Paris, tom. i. pl. 65. 1, 2. It has also received several other names, such as *Ter. gigantea*, which, according to Baron Leopold von Buch, would be the same as Lamarck's type: several specimens are to be seen in B. Delessert's collection.

33. *Terebratula Kleinii*, Val. in Lamk. Pl. XIII. fig. 33.

T. testa ovata, depressa, subantiquata, lævi, superne biplicata creberrime et subtilissime punctata: nate incurva.

Obs. Several persons, and among others M. Deshayes (new ed. of Lamarck), refer to this species the *Ter. globata* of Sowerby. M. Valenciennes, who was the original describer of the species, convinced me of the mistake, which can be at once seen from three type specimens in the collection of the Garden of Plants; one of which I have figured in my plate: it belongs to the oolitic beds, probably from Normandy. Lamarck's reference to *Anomya Terebratula* of Linnæus may have led to this mistake. M. D'Orbigny has also fallen into the common error in his 'Pro-drome' by attributing *Ter. globata* to Lamarck's species.

34. *Terebratula Pedemontana*, Val. in Lamk. Pl. XIV. fig. 34.

T. testa subrotunda, subdepressa, transversim striata, superne biangulata: umbone elevato, nate recurva. Coll. Museum.

Obs. M. Valenciennes in his description of this species states that it approaches the preceding one above all by the rounded

form of its two plaits : one specimen is to be seen in the museum of the Garden of Plants, which was found by Sig. Bonelli in the tertiary beds near Turin in Italy.

35. *Terebratula quadrifida*, Val. in Lamk. Pl. XIV. fig. 35.

T. testa triangulari-depressa, dilatata, lævi, superne quatuor angulis acutis instructa : nate brevi.

Obs. This is a well-known species, common to the liasic beds of France and England ; one specimen only exists in Lamarck's collection at B. Delessert's ; it is one of the various shapes this species assumes, passing by insensible gradations into *Terebratula cornuta*, Sow. : nor is it uncommon to find (as can be seen in M. Deslongchamps' cabinet) specimens, one half of which is *quadrifida*, while the other half is *cornuta* : therefore Lamarck's name should be kept for the species, and *cornuta* cancelled from the nomenclature.

36. *Terebratula angulata*, Val. in Lamk. Pl. XIV. fig. 36.

T. testa subtrigona, ventricosa, lævi, margine supero valde sinuato, tribus angulis acutis.

Obs. Three specimens are to be seen in B. Delessert's collection, but which belong to as many species, so that it is difficult to know which Lamarck intended as his type ; this however is of little importance, as the name must be canceled, it having been given many years before by Linnæus to a mountain limestone shell differing from Lamarck's specimen.

37. *Terebratula multicarinata*, Val. in Lamk. Pl. XIV. fig. 37.

T. testa magna, rotundata, pectiniformi, costis numerosis carinata : margine non sinuato.

Obs. It is singular that M. D'Orbigny makes no allusion to Lamarck's species, which holds priority over Baron Leopold von Buch's *Terebratula peregrina* published long after 1834, and which M. D'Orbigny adopts in his 'Paléontologie Française,' when at a few steps from his own door he could have seen a fine specimen of this species in Lamarck's collection at B. Delessert's. It is one of the largest Terebratulæ known, and would appear to belong to the Neocomian beds of Châtillon (Drome). Lamarck's type specimen, of which I give a reduced figure, measured in length and breadth 3 inches and $1\frac{3}{4}$ inch in depth, but the species attained much greater dimensions, as can be seen from specimens in the British Museum. It has been well figured by M. D'Orbigny in his 'Pal. Franç. Ter. Crétacés,' vol. iv. p. 493, and in the 'Mém. de la Soc. Géol. de France,' vol. iii. p. 156. pl. 15. fig. 28.

38. *Terebratula tetraëdra* (Sow. M. C. tab. 83. fig. 4).

Obs. The specimens attributed to this species in Lamarck's collection do not belong to Sowerby's type, but to that beautiful and well-characterized species known under the name of *Terebratula decorata*, Schloth., so admirably illustrated and described by M. Le Vicomte D'Archiac in the 'Mém. de la Soc. Géologique de France,' and also well represented in pl. 244. fig. 2. of the 'Encyclopédie Méthodique.' Lamarck, singular to say, had in his collection specimens of Sowerby's type, but which he places in his *Terebratula spathica*.

39. *Terebratula plicata*, Val. in Lamk. Pl. XIV. fig. 39.

T. testa subtetraëdra, subgibbosa, plicata, non sinuata : 5 vel 6 costis ab umbone obtusis, et ad marginem angulatis : nate brevi.

Obs. Lamarck or Valenciennes refers to the 'Encyc. Méthodique,' pl. 243. fig. 11 and pl. 244. fig. 1, and states that his species approaches the preceding one : but the absence of a sinus forcibly distinguishes it. This species is well characterized, and seems to belong to the liassic beds of the north of Italy. There exist, besides the two specimens described by M. Valenciennes, in the Garden of Plants, a number of fine specimens from the collection of the Marquis de Drée. In B. Delessert's collection we also find two specimens labeled *Terebratula plicata* var., which however belong to the *Inoceramus sulcatus* and to the *Pecten quinquecostatus*. Lamarck's *Terebratula plicata* being a good species should be retained. Mr. Buckman was not aware of Lamarck's priority when he attached a similar name to another species. M. D'Orbigny in his 'Prodrome' has given to Mr. Buckman's shell the name of *Terebratula subplicatella*, D'Orb. 1847, which however he had no right to do according to his views, because Lamarck's species not being a true type of the genus *Terebratula*, would be placed by him in the genus *Hemithyris* or some other of his proposed genera, while Mr. Buckman's *Ter. plicata* might then remain in the *Terebratulas*. Lamarck's species varies in the number of plaits on the mesial fold ; some specimens present four plaits, others five, and in a few specimens two plaits unite into one towards the margin of the shell.

40. *Terebratula canalifera*, Val. in Lamk. Pl. XIV. fig. 40.

T. testa trigonata, gibba, longitudinaliter sulcata, sinuata, cardine recto : nate declivi.

Obs. The *Terebratula canalifera* of Lamarck belongs to the genus *Spirifer*, and reference is made to pl. 244. fig. 4, 5 and 6. of the 'Encyclopédie Méthodique : ' fig. 5, which appears to be the type, and is a well-known Devonian species from Paffrath

near Cologne, described and figured by Schlotheim in 1822 under the name of *Terebratulites aperturatus*, Nachträgen, pl. 17. fig. 1. Lamarek's name published in 1819 ought to have priority; the species would therefore be the *Spirifer canalifera* (Val. Sp. S.). All the figures referred to in pl. 244 of the 'Encyclopédie' do not however belong to the same species; fig. 5 would be the *Spirifer canalifera*, fig. 4 the *Spirif. Verneuilii* (Murch.), and fig. 6 the *Spirif. Archiaci* (Murch.). We also find assembled under the same head in the collection of the Garden of Plants, as well as at B. Delessert's, besides the above-mentioned species, specimens of *Spirif. rostratus* from the lias, and *Spirif. Bouchardii* from the Devonian beds. One specimen of *Spirif. Verneuilii*, which I figure in my plate under the number 40 A, shows the perfect deltidium, rarely preserved in the Spirifers of that species.

41. *Terebratula lævicosta*, Val. in Lamk. Pl. XV. fig. 41.

T. testa trigonata, gibba, lateribus sulcata: in medio valvæ majoris sinu et minoris costa lata, utriusque lævibus, transverse striatis: cardine recto, nate recurva.

Obs. No reference as to figure is given by Lamarek; all that is stated is, that the "fossil comes from Benberg near Cologne." However M. Valenciennes kindly informs me, when sending his type specimens, that he received the shells on which he established the species in 1817 from Prof. Nöggerath on his visit to Bonn: it is the same shell figured and described in 1822 by Schlotheim under the name of *Terebratulites ostiolatus* (Nachträgen, pl. 17. fig. 3), placed afterwards in the Spirifers by B. von Buch (Mém. Soc. Géol. de France), and by Bronn in König's genus *Trigonotreta*; but as M. Valenciennes appears the oldest describer of the species, it should retain the name of *Spirifer lævicosta* (Val. Sp. S.); it belongs to the Devonian beds of the Eifel, and not to Benberg as stated by Lamarek.

42. *Terebratula intermedia*, Val. in Lamk. Pl. XV. fig. 42.

T. testa subtetraëdra, dilatata, plicata, sinuata, 4 costis ad sinus 5 ad latus: nate brevi.

Obs. I was not able to find the original specimen on which the species was established, but reference is made to pl. 245. fig. 3 *a, b.* of the 'Encyclopédie Méthodique,' which is sufficient. I have thought it advisable, in order to complete the series, to give here the figure out of that work. Lamarek states that his species is intermediate between *Terebratula tetraëdra* and *plicata*: it evidently belongs to the jurassic period.

43. *Terebratula alata*, Val. in Lamk. Pl. XIV. fig. 43.

T. testa subtrigonata, subgibba, superne sinu cavo exarata, creberrime sulcata: nate brevi.

Obs. Lamarck refers to pl. 245. fig. 2 *a, b.* of the 'Ency. Méthod.,' but as M. Deshayes justly observes in his new edition of Lamarck, this species is the same as that published in 1814 by Brocchi under the name of *Anomya Vespertilio*, Conchologia Fossile, fig. 17, which is also evident from specimens both in the collection of the Garden of Plants and of B. Delessert's museum. M. Deshayes also remarks, that on looking at the figures 1 and 2 of the pl. 245, one would have some difficulty in believing that both belonged to the same species: I agree with M. Deshayes in this—fig. 1 would agree with Brocchi's type and Lamarck's specimens. This species varies much, as can be well seen in M. D'Orbigny's figures, Pal. Franç. vol. iv. pl. 499. fig. 1–7. Fig. 2. pl. 245, the one referred to by Lamarck, is probably *Terebratula compressa*, Lamk. no. 54, as it shows that peculiarly shaped front so well displayed in this shell; however there are more than one species placed under this head in the Paris collections. At the Garden of Plants we find on the same tablet a specimen of *Terebratula Vespertilio* associated with *Ter. latissima* of Sowerby, and at M. Delessert's we see three or four species, among which, under the head of variety, is placed a specimen of *Pentamerus*, a *Spirifer*, and a *Terebratula* of quite another shape. This association is so strange that I can hardly believe they were so put together by Lamarck. Brocchi's name however should be preserved to this species, and that of Lamarck placed among the synonyms. The identity of Lamarck's species with that of Brocchi is also admitted by M. D'Orbigny in his 'Pal. Française Ter. Crétacés,' vol. iv. p. 44.

44. *Terebratula concinna* (Sow. M. C. tab. 83. fig. 6).

Obs. The specimens under this name in B. Delessert's collection appear to belong to *Ter. obsoleta*, Sow.

45. *Terebratula media* (Sow. M. C. tab. 83. fig. 5).

Obs. The specimens ticketed thus by Lamarck belong to Sowerby's true *Ter. tetraëdra*: the distinctions between *Ter. tetraëdra* and *media*, Sow., are very trifling.

46. *Terebratula pectita* (Sow. M. C. tab. 138. fig. 1).

Obs. I did not find any specimens of this species in either of Lamarck's collections.

47. *Terebratula Cardium*, Val. in Lamk. Pl. XIV. fig. 47.

T. testa elongato-ovata, convexa, plicata, sulcis longitudinalibus crassis, rotundatis: nate prominula.

Var. *b.* testa compressiuscula, sulcis crebrioribus.

Obs. Lamarck refers to pl. 241. fig. 6 *a, b, c.* of the 'Ency. Méthod.,' and this species is too well known to require many re-

marks, except that it must have priority over *Terebratula orbicularis* of Sowerby, M. C. 1829, of which *Ter. furcata* of the same author is only a young state. It is curious however to see, that notwithstanding M. D'Orbigny's professions of attending always to date, that in his 'Prodrome' he adopts Sowerby's *Ter. orbicularis*, and makes no mention of Lamarck's *Ter. Cardium*, published long before. Similar mistakes are not however rare in that work, nor would I here think it necessary to call attention to this point, if M. D'Orbigny's severity towards others was not so forcibly brought forth in his writings*. The plaits, which are often divided towards the margin in this species in the young age, are also, though rarely so, in the adult, as may be seen on specimens in M. Deslongchamps' collection: the loop process also extended to near the margin, as I hope to illustrate in another work. Lamarck's var. *b*, as can be seen from the specimens in the Garden of Plants, belongs to *Terebratula spinosa*.

48. *Terebratula difformis*, Lamarck and Val. Pl. XV. fig. 48.

T. testa trigonata, dilatata, subdepressa: margine inæqualis in medio sinuoso-deflexo: nate subproducta.

Obs. Lamarck refers to 'Encycl. Méthod.' pl. 242. fig. 5 *a, b, c*, and gives Cap la Heve near Havre, and Mans, both greensand localities. M. D'Orbigny admits this species in his 'Pal. Franç.,' and places it in Fischer's genus *Rhynchonella*. *Terebratula dimidiata*, Sow., would also belong to the same species. However, if we inspect the specimens ticketed by Lamarck in M. Delessert's collection, we shall find that three out of ten belong to his species from the *Tourtia* beds of Tournay; the others being oolitic shells, with the exception of one, which would appear to belong to Sowerby's *Terebratula latissima*.

49. *Terebratula lyra* (Sow. M. C. tab. 138. fig. 2).

50. *Terebratula Menardi*, Lamarck and Val. Pl. XIV. fig. 50.

T. testa gibberula, globosa, inferne truncata, valva majori sinu longitudinaliter sulcato excavata: margine sinuoso deflexo.

Obs. In B. Delessert's collection we find ten specimens of this

* Certain things which might pass with the early naturalists cannot be allowed at the present day, such as simply to describe a species by a few words, which description would suit twenty others; therefore all the new names introduced into M. D'Orbigny's 'Prodrome' cannot claim priority. Should any one fully describe and figure before M. D'Orbigny any of those simply named species which have but three or four words of description and with no reference to figure, the names of the subsequent author ought to be retained; otherwise the practice of M. D'Orbigny would retard science, to say nothing of the injustice and abuses to which it would inevitably lead.

species belonging to the greensand of Mans. M. D'Orbigny admits this species, which he places in his genus *Terebratella*, and states in vol. iv. p. 116 of his 'Pal. Franç.' that the *Terebratula truncata*, Sow., 1826, M. C. vi. p. 71. pl. 537. fig. 3, belongs to a distinct species, and not to *Terebratula Menardi*, Lamk., and to which he gives the new name of *Terebratella Asteriana*, as he cannot retain the name of *Ter. truncata*, it having been given by Linnæus to another shell. There exists however some doubt if on this point M. D'Orbigny's opinion is correct; the general form in *T. Menardi* is often, though *not always*, broader than in our Faringdon specimens, the ribs sharper, and depression of the dorsal valve deeper, and bounded laterally by sharper ridges, lines of growth less strongly marked, mesial longitudinal process on inner side of ventral valve shorter and not so strong. Lamarck's specimens do not appear to vary so much in form as our Faringdon specimens, and have a much thinner shell; but on examining with great care a numerous suite of specimens of these species, both in the collection of the British Museum and those collected by myself in both localities, Messrs. Waterhouse, Woodward and myself believe that the species may be the same, and that the greater or less thickness of the shell might arise from the difference of the water in which they lived; the Faringdon specimens being much worn, so that the plaits must have been much sharper in the living state.

51. *Terebratula decussata*, Val. and Lamk. Pl. XIV. fig. 51.

T. testa subpentagona, subconvexa, valva majori canaliculata, striis transversis tenuibus longitudinaliter decussantibus: nate subproducta foramine magno.

Obs. Lamarck refers to the 'Encyc. Méth.' pl. 245 *a, b, c*. However, in 1811, before Lamarck, Parkinson described and figured this species in the 3rd vol. of his 'Organic Remains,' pl. 16. fig. 5, under the name of *Terebratula coarctata*, which name must be preserved to the species, as M. D'Orbigny has done in his 'Prodrome,' vol. i. p. 316, and Lamarck's name placed among the synonyms along with Sowerby's *Terebratula reticulata*, M. C. tab. 312. fig. 5, 6. The *Ter. coarctata* is very common in the Forest marble and Bradford clay. The only specimen Lamarck had is in B. Delessert's collection.

52. *Terebratula spinosa*, Val. in Lamk. Pl. XIV. fig. 52.

T. testa globosa, dilatata: sulcis parvis spinosis: nate brevissima acuta.

Obs. This species seems to have been first named by Smith, 'Strata identified by Fossils,' 1816 or 1817. Deshayes and Morris also refer to Knorr, Test. Diluv. It is a well-known inferior

oolite species. Lamarck's three specimens are to be seen in the collection of the Garden of Plants with the following locality, "Mortagne près Alençon, Brière:" it is common in Normandy and in England.

53. *Terebratula spathica*, Val. in Lamk. Pl. XIV. fig. 53.

T. testa subtrigonata, subglobosa, lævi: margine supero sinuato: nate acuta subproducta.

Obs. Lamarck gives no reference to a figure, but states that his specimens come from the hills on the boundary of the Sarthe; and I am at a loss to know what is the type of this species, not from want of specimens, but from the number of different species placed under one head in Lamarck's two collections—thirty specimens under this name, some referable to the *Ter. tetraëdra*, Sow., *Ter. concinna*, Sow., *Ter. media*, Sow., *Ter. varians* and *Ter. rimosa*, and perhaps another species; so that as there would always exist much doubt as to the real type, it will be necessary to cancel this species from the nomenclature. In my plate I have figured two of the specimens ticketed by Lamarck as *Ter. spathica*, as some of the boards bear the title of "variety": one is Sowerby's *Ter. tetraëdra*, the other *Ter. varians*.

54. *Terebratula compressa*, Val. in Lamk. Pl. XV. fig. 54.

T. testa dilatata, margine supero denticulato subflexuosa: nate producta acuta.

Obs. Although no reference is given by Lamarck, this is a well-known greensand shell from Mans, and admitted by M. D'Orbigny in his 'Pal. Franç. Ter. Crétacés,' pl. 35, who gives also a long list of synonyms relating to it: the plaiting of the margin in this shell is very peculiar.

55. *Terebratula granulosa*, Val. in Lamk. Pl. XIV. fig. 55.

T. testa subdepressa, rotundata, margine supero antice in rostrum producto: sulcis granulosus: nate brevi.

Obs. No reference as to figure is given, but Lamarck states that the specimens were brought from Monte Mario near Rome by Cuvier. There must however exist some strange mistake in this statement, as many specimens are labeled by Lamarck *Ter. granulosa* both in B. Delessert's collection and that of the Garden of Plants, specimens which never could have been found *in situ* at Rome, where we only find volcanic and tertiary deposits, while the specimens named so in the collections belong not only to different formations, but to different species: thus we find a specimen of *Terebratula reticularis* of Linnæus in B. Delessert's collection ticketed *Ter. granulosa* by Lamarck, and which I have

figured in my plate ; besides other specimens of a Neocomian species labelled *Ter. granulosa* var., a figure of which I have also given ; and in the collection of the Garden of Plants, besides these last-named shells, we find a specimen of *Terebratula spinosa* and *varians* : it is therefore evident that this species must be cancelled from the nomenclature, since none of the species therein placed could claim a preference.

56. *Terebratula Articulatus*, Val. in Lamk. Pl. XIV. fig. 56.

T. testa trigona, depressa, tenerrime longitudinaliter striata : margine supéro angulato : nate brevi.

Obs. No reference is given, except that the specimen is in the museum of the Garden of Plants, where I found it, and that it is from the Dep. of the Sarthe. "The smooth surface of this species (adds Lamarck) and its deeply angular front give to it the aspect of the articulation of a shell ;" but on examining his specimen, as can be seen by the figure, it has some characters of M. Richard's *Terebratula Cynocephala* and *furcillata*, as the greater half of the valves from the beak and umbo are ornamented by numerous small longitudinal striæ which do not extend to the margin of the shell ; it belongs probably to the lias deposits, and I have never seen but the one specimen on which the species was established.

57. *Terebratula radiata*, Val. in Lamk. Pl. XIV. fig. 27.

T. testa subdepressa, inferius coarctata, superne dilatata, rotundata, sulcis longitudinalibus radiatis, margine subflexuosa.

Obs. No reference is given by Lamarck, except that the specimens are in the museum of the Garden of Plants, where I found them. It is probably a Neocomian shell, at least the specimen which I consider the type, and which I draw in my plate. It approaches in form to *Rhynchonella paucicosta*, D'Orb. Pal. Franç. pl. 494. fig. 1, 5.

58. *Terebratula pumila*, Lamarck. Pl. XIV. fig. 58.

T. testa minima, compressa, valva minori complanata, sulcis longitudinalibus radiatis : nate acuta producta.

Obs. As M. Deshayes justly remarks in his new edition of Lamarck, this species belongs to the *Thecidea radiata* (Defrance), and not to the *Magas pumilus* of Sowerby. Several specimens are to be seen both in M. Delessert's collection and in that of the Garden of Plants, which are derived from the chalk of Maestricht.

59. *Terebratula spirifera*, Val. in Lamk. Pl. XV. fig. 59.

T. testa trigonata, transverse dilatata, spiris ad latera decurrentibus instructa, margine supéro angulata : nate brevi perforata.

Obs. Lamarck refers to the 'Encyclopédie Méthodique,'

pl. 246. fig. 1 *a, b*, but on inspecting that figure, one might be led to consider that the species must be either *Terebratula acuminata* or *Ter. Meyendorffii*, De Verneuil, Geol. of Russia. However, we find in B. Delessert's collection a specimen of *Ter. acuminata* with that name written by Lamarek, to which he added ("non décrit"). In a letter I lately received from M. Valenciennes, the original describer of the species, he distinctly states that his *Ter. spirifera* is the same shell as that subsequently described and figured by Sowerby in the 'M. C.' under the name of *Spirifer striatus*, which he proves by sending me the original specimen given to him in 1817, when in London, by the author of the 'Mineral Conchology,' a restored figure of which I give in my Pl. XV., M. Valenciennes' specimen being much broken and incomplete. It is, as every one knows, a common carboniferous shell in many countries, and has also received many names. Sowerby published it in 1821, and M. Valenciennes in 1819; but I do not know how far the last-mentioned author's species would have a right to priority over Sowerby's, on account of the false reference given to quite another shell in the 'Ency. Méth.' It is however certain, from the type specimen before me, as well as from the Latin description, "*transverse dilatata, spiris*," that the describer had in view the same shell described afterwards under the name of *Spirifer striatus*. M. Deshayes, in his new edition of Lamarek, was led naturally into the mistake, as any one would have been. He states that "this species is the same as *Ter. acuminata* of Martin and Sowerby, and the figure referred to in the 'Ency. Méth.' would lead one to believe so; but as it is very bad, and only inexactly represents *Ter. acuminata*, it has not prevented me adding here the species intended."

XXXVIII.—On the Internal Structure of *Terebratula pectunculoides*, Schl., *Terebratula pulchella*, Nils., and *Terebratula Deslongchampsii*, nob. By THOMAS DAVIDSON, Esq.

[With a Plate.]

As my intentions are to publish shortly some views relating to the internal calcareous support of the ciliated arms in *Terebratula* and allied genera, I have simply given in Pl. XV. illustrations of two of these supports, hitherto unfigured.

Fig. 4. Pl. XV. represents *Ter. pulchella*, Nils., and its internal calcareous loop, from a specimen derived from the chalk of Belgium, now in the cabinet of M. Deslongchamps.

Fig. 5. Pl. XV. represents *Ter. pectunculoides* (Schl.) and its internal calcareous support considerably enlarged, from two spe-

cimens derived from the Korallenkalk or white jura of Nattheim, Wurtemberg, and to be seen in the collection of Fossil Terebratulæ of the British Museum, so beautifully worked out by the indefatigable exertions of Messrs. Waterhouse and Woodward.

Terebratula Deslongchampsii, nob. Pl. XV. fig. 6 *a, b*.

Shell small, oval, subdepressed; dorsal valve much more convex than the ventral one; beak straight, truncated by a large foramen extending to the umbo of the ventral valve, partly surrounded by the substance of the beak, by a small portion of a disunited deltidium, and a part of the umbo. Valves closely covered by numerous strong, short, tubular spines or granulations, between which the punctuation is visible: this structure being the same as that observable on *all* the lias Spirifers yet discovered, gives to the shell a rough feel similar to that of *Ter. lima* (Def.), but from which it differs completely.

This remarkable little shell is placed provisionally among the *Terebratulæ*, as I consider a knowledge of the internal appendages essential before one can say positively to what genus an unknown species belongs, as judging solely from external characters one may often be led to place a shell in a very inappropriate genus. It has the beak, deltidium and foramen of *Waltonia* and *Terebratulina*, and, as can easily be seen, the internal apophysary system in both differs completely, so that it may perhaps belong to one of these genera. Length $3\frac{1}{2}$ lines, breadth 3 lines, depth $1\frac{1}{2}$ line.

Only four or five specimens of this little shell are known as yet in the collections; viz. one specimen was found by M. Tesson, two by M. Breville in the lias beds of Curcy, and one by myself at Vieux Pont, between Caen and Bayeux. It was however familiar to M. Deslongchamps some years back, who kindly forwarded me drawings he had made from M. Tesson's specimen. I take much pleasure in dedicating this species to M. Deslongchamps.

Pl. XV. fig. 6. nat. size of the species; 6 *a*, enlarged figures.

XXXIX.—*On some Inhabitants of the Freshwater Muscles*.

By C. VOGT*.

SINCE the interesting researches of M. Baër†, it is well known that the freshwater Muscles are infested by a number of Entozoa of extraordinary form: *Cercaria*, *Bucephali*, tailed *Distoma*, and numerous other Trematoda in the state of larvæ and

* Translated from the *Annales des Sciences Naturelles*, Oct. 1849.

† Nov. Act. Acad. Leopold. Carol. vol. xiii. Pars 2.

of perfect individuals, frequently swarm in the organs of these animals. During my stay at Giessen I undertook a series of researches on the embryology of the various animals which inhabit the freshwater muscles; these investigations were interrupted by the revolution of 1848. Having no opportunity of resuming them immediately, I consider it a duty to call the attention of naturalists to a field of investigation which promises a rich harvest. Embryologists especially will find in the freshwater muscles matter to satisfy them; for they present not only their own eggs and the larvæ of bivalves which hatch in their gills, but also eggs and embryos of Entozoa, of articulated and even vertebrated animals.

The eggs of the freshwater muscles pass into the gills in the beginning of May. I have not been able to observe the passage itself, but I have notwithstanding traced the development of the egg in the first stages of the embryogenic process. I have seen the division of the vitellus in all its phases, up to the formation of a globular embryo, which still wanted a shell. By comparing the eggs concealed in different parts of the gills, I convinced myself that the eggs placed near the anus were more advanced in this process than those which were in the anterior portion of the gills; the latter therefore appear to be filled from before backwards. The eggs, in the ovary, arrived at a certain stage of maturity, are always composed of a transparent envelope, and of a granular vitellus of a whitish, yellow or orange colour, in which is situated the Purkinjean vesicle. This vesicle is very large, entirely transparent, and always contains two small vesicles (germinative spots of Wagner), one of which sometimes presents a granular appearance. It is a general law, as regards the eggs of the Unios and Anodonts, that these spots are to the number of two in each egg.

The ovary and testicle are the habitual seat of those larvæ of Trematoda, which M. Baër has designated under the name of *Bucephalus polymorphus*. The figures which M. Baër has given of these singular animals are tolerably correct. They are formed of a distomoid body placed on two long rolled-up appendices which have a serpentine movement. These larvæ are developed in the long filiform intestines, which, under the microscope, exhibit now and then swellings, in which are lodged the *Bucephali*. The sexual organ affected by this dyscrasy resembles a mass of entangled white threads; I found one individual in about two hundred freshwater muscles, the ovary of which had the appearance of a fibrous schirrus macerated for some time. These threads are especially developed in January and February; and it is also in these months that the development of the *Bucephali* may be easily observed. In the swellings of the intestines, globules

formed of a finely granular substance occur; the globules lengthen, become elliptic; they send out prolongations at one of the extremities, at first very broad, which are not distinguishable by any peculiarity of their tissue from the body to which they are attached. But as they grow, they separate from the body by a groove, fill it with granulations, and finally become nearly filiform, coiling themselves up like horns. The body to which these appendages belong, grows in proportion, lengthens, takes the form of a *Distoma*, and finally casts off the appendices. This separation sometimes takes place under the eye of the observer; and what is especially remarkable is, that the primitive globule, which is thus transformed, does not present a cellular structure: neither nucleus nor envelope is observable; it is a simple globule of waxy consistence, which is easily flattened by the compressor.

The *Bucephali* are, as I have shown by the proportion in which they are found, rare in the environs of Giessen. More frequently, and especially in spring, the sexual organ of the freshwater muscles is found affected by another helminthic dyscrasy. The ovary is then coated here and there with small granules of a deep red-brown colour. These granules are cysts filled with eggs and larvæ, to which M. Baër has given the name of *Distoma duplicatum*. The body is that of a true *Distoma*, furnished with an appendix still longer than the body, and formed solely of large fibres folded in zigzag, and inclosed in a transparent sheath. I have found in a single cyst as many as ten larvæ coiled up, and surrounded by a score of eggs in different stages of development. The larvæ and eggs are of a deep orange colour.

Another guest as yet too little known is met with in summer in the viscous liquid surrounding the heart of these freshwater muscles: this is the *Aspidogaster conchicola* of M. Baër. Nearly one individual in a hundred is found affected with these curious Entozoa. The adult *Aspidogasters* are almost always filled with eggs, in which rolled-up embryos are easily distinguished: what most struck me in these embryos furnished with two suckers was the detection in them of an organ situated in the first third of the body, at the margin of the anterior sucker, closely resembling the organ of hearing in the larvæ of Mollusca. This organ is simple, placed on the median line of the body, and is formed of a transparent vesicle, containing a lithoid body composed of two rounded and nearly equal halves. The general form of the embryos of the *Aspidogaster* differs much from that of the adults.

It is evident, from what we have stated, that it is easy to procure in the freshwater muscles the necessary materials for the investigation of the embryogenic history of a mollusk and of three species of Trematoda; but this is not all.

M. Baër, and after him M. Pfeiffer, have noticed an *Acarus* which dwells in the pallear cavity of the Naiades. M. Baër called this *Acarus Hydrachna concharum*. M. Pfeiffer, who was not then acquainted with M. Baër's investigations, gave it the name of *Limnochares Anodontæ*.

The eggs of this *Acarus* are arranged under the external lamella of the branchial lobes; they form granular masses of a whitish colour, which are very easily discerned through the thin membrane which covers them. It is sufficient to remove this membrane or tear it with a needle to lay bare the eggs, which are just large enough to be visible to the naked eye. The vitellus, composed of fatty globules, gives a whitish colour to these eggs, the envelope being perfectly transparent. I know no eggs of articulated animals which so readily admit of microscopical observation. The envelope is of a consistence sufficient to protect the embryo against a gentle pressure; so that it is easy to move the egg under the compressor in any desired direction without injuring the inclosed embryo; we may also, without much difficulty, succeed in removing this envelope by cautious pressure, and liberating the embryo without any disfiguration. The eggs are so numerous that there is no need to be sparing of them. A freshwater muscle is rarely opened in winter the gills of which do not contain hundreds of eggs in different stages of development, and it is always easy to compare the structure of the embryos with that of the young or adult animals, because the latter occur always in large number on the gills and on the internal surface of the mantle. The embryo carries the vitellus a long time after the hatching on the dorsal surface of the body; it comes out of the egg having only three pairs of legs, whereas the adult has four.

Lastly, I found, during the months of June and July, a great number of young fishes lodged in the gills of the freshwater muscles. The first time that I made this observation, I could scarcely believe my eyes, and at first I thought it was the effect of an extraordinary chance. But I was deceived; in a hundred freshwater muscles opened in the months mentioned, I found, at least in sixty, small fishes all belonging to the same species, at different degrees of development. I found as many as forty in a single freshwater muscle, the gills of which were then considerably enlarged. I rarely met with eggs; they were yellow, like the yolk of hens' eggs, of an oval form, and about 1 millimetre to $1\frac{1}{2}$ long. The embryos quit the eggs very early; the youngest that I have met with could not yet move, and were so little advanced, that the black pigment of the eyes had scarcely begun to be deposited. The largest fishes which I met with in the gills were 10 millimetres long; they swam with vivacity,

although still bearing the vitellary sac concealed in the abdomen.

The fishes' eggs are, without doubt, introduced by the respiratory current of the freshwater muscles. But their early exit from the egg, at a period when the embryos of other fishes still remain in the egg, as well as their whole manner of existence, seem to me to prove that the gills of the freshwater muscles are the habitual place of incubation of these embryos. They are all concealed there in the same fashion, with the head turned toward the free edge of the branchial lobes; they thus fill the elongated cavities between the two plates of a branchial lobe, and it is only necessary to cut the external membrance in order to set the embryos at liberty. It is then curious to follow the movements of the oldest. After making some turns in the vessel containing them, they return toward the gill, and eagerly attempt to penetrate into it. I have often seen them re-enter the respiratory canal, and conceal themselves again in a branchial cavity where they then kept quiet.

I have not been able with complete certainty to ascertain to what species of fish these little ones belong. The oldest which I have met with had not yet any generic character; they all still possessed the embryonic fin continuous around the posterior extremity of the body, and the ventral ones were altogether wanting. But as I know the eggs of nearly all the genera of fishes inhabiting our soft waters, I have reason to believe that these eggs are of the *Cottus Gobia*, Linn., a species common in our small rivers.

These embryos are remarkably distinguished from all those which I have hitherto observed; the vitellus is almost opaque and of a yellow colour, which, under the microscope, appears of a deep brown. The vitellary sac has a very elongated form, and the young fish is lodged in a very deep depression of this enormous vitellary sac. The difficulty of observation which results from this disposition is further increased by two lateral swellings of the yellow mass, swellings which rise where the pectoral fins have to come out. The swellings of the vitellus enter indeed into the base itself of the pectoral fin in the more advanced embryos, and thus conceal all the anterior part of the body. To examine the heart and the branchial region of the embryo, the vitellary sac must be emptied, which soon causes the circulation to cease.

Embryonic researches among the inferior animals are often only rendered so difficult by the want of proper materials. I shall be happy if I have contributed to remove some of these difficulties, and I am sure that analogous researches on sea mollusks may lead to numerous discoveries of the same kind.

XL.—*Notices of British Fungi*. By the Rev. M. J. BERKELEY,
M.A., F.L.S., and C. E. BROOME, Esq.

[Continued from p. 380.]

[With two Plates.]

ERIOSPORA, n. g.

Stroma multicellulare; cellulis globosis poro unico communi sporas filiformes tenerrimas primo quaternatim sporophoras coronantibus effundentibus.

438. *Eriospora leucostoma*. On dead leaves of *Typha*, Spy Park, Wilts, Feb. 1850, C. E. Broome.

Spots pitch-brown, very thin and diffused toward the edges, not a line broad, marked in the centre with a punctiform white-bordered pulverulent aperture. Stroma depressed. Cells varying in number, generally globose, but sometimes from the confluence of one or more depressed. Spores very long, filiform, so delicate that they wave from the minute currents formed by the evaporation of the water in which they are placed for examination on the table of the microscope, at first seated four together on short cylindrical sporophores, but soon falling off.

Not unlike the foregoing species, but the spores forbid its being placed in the same genus. It exactly answers to the genus *Robergea* of the *Ascosporous* series.

PLATE XI. fig. 1. Spores with their sporophores highly magnified.

439. *Glæosporium paradoxum*, Mont. in litt. = *Myxosporium paradoxum*, D. Not. Mic. Dec. 2. fig. 10. On leaves of ivy, Penzance, J. Ralfs, Esq.; King's Cliffe.

440. *G. labes*, Mont. in litt. = *Asteroma labes*, Berk. Brit. Fung. no. 346.

441. *G. concentricum*, Berk. & Br. = *Cylindrosporium concentricum*, Grev. Scot. Crypt. Fl. t. 27.

Authentic specimens lately forwarded for inspection by Dr. Greville show the spores to be produced beneath the cuticle, and to form little heaps by oozing out as in other species of *Glæosporium*. The notion formerly broached, of its being a form of *Cystopus candida*, arose from a specimen in Sir W. J. Hooker's herbarium received from Dr. Greville, but which unfortunately was not the true plant, but a form of the common white rust with cylindrical truncate spores.

441*. *Cheirospora botryospora*, Fr. Summa Veg. Scand. p. 499 = *Hyperomyxa stilbosporoides*, Corda, Ic. Fasc. 3. fig. 89 = *Stilbospora botryospora*, Mont. Ann. d. Sc. Nat. 1837, t. 18. fig. 5. Abundant on beech twigs, Wraxall, Somers., C. E. Broome, Bristol, H. O. Stephens, Esq.

Fries proposed the name of *Cheirospora* in the addenda to 'Syst. Orb. Veg.' in 1825, more than ten years before *Thyrsidium*, Mont., and we therefore adopt his name in preference to *Myriocephalum*, D. Notaris, a name proposed much later than *Thyrsidium*, but in favour of which Dr. Montagne had kindly waved his title to priority.

442. *Pilidium carbonaceum*, Lib. = *Cenangium fuliginosum*, Fr. On willow branches, King's Cliffe, &c.

This is no *Cenangium*, being destitute of asci. The spores are falciform and septate. We scarcely think it a good *Pilidium*, according to Kunze's notion of the genus, taking *P. acerinum* as the type.

443. *Melasmia acerina*, Lév. Ann. d. Sc. Nat. May 1846, p. 276. On leaves of *Acer Pseudo-platanus*, Beddellart, Horatio Piggot, Esq.

Resembling very much a depauperated state of *Rhytisma acerinum*, or rather *R. punctatum*, but differing greatly in structure, having no asci, but minute oblong spores.

444. *Excipula macrotricha*, n. s. Peritheciis hispidis; pilis longis rectis; sporis minimis lunulatis. On dead branches of *Ulex europæa*. The precise locality has not been preserved.

Perithecia larger than in the other species, coarsely hispid; hairs long, thicker than in *E. Vermicularia*, Corda; their inner tube separating easily from the outer. Spores far more minute, lunulate.

A much coarser species than that just mentioned, easily recognized by its larger size, coarser hairs, and minute spores.

445. *E. chælostroma*, n. s. Gregaria convexa cinerea ubique setis nigris percursa; sporis lunatis, subfusiformibus. On dead ash keys, Leigh Wood, Somersetshire.

Minute, convex, black; disc rough, with the long inarticulate bristles which everywhere penetrate its substance. Spores on rather long fasciculate or connate sporophores, lunate, subfusiform, acute at either extremity, pale; endochrome granulated, green under the microscope.

This is to the genus *Excipula* precisely what *Desmazierella* is to *Peziza*; but as the species is so much lower in the scale, we consider the protrusion of the bristles through the disc as of less importance, and therefore do not regard it as generically distinct. It is in fact an *Excipula* in every other respect. We have a closely allied species on some *Panicum* from South Carolina.

PLATE XI. fig. 2. *a.* Plant nat. size on an ash key; *b.* portion showing the stroma, hairs and spores, with their sporophores magnified; *c.* sporophores and spores more highly magnified; *d.* spores very highly magnified.

446. *Dinemasporium gramineum*, Lév. Ann. d. Sc. Nat. May

1846, p. 274 = *Excipula graminum*, Berk. Br. Fung. no. 328. A second species of this genus occurs in South Carolina.

MYXORMIA, n. g.

Perithecium tenue excipuliforme apertum e cellulis elongatis compactum. Sporophoræ teneræ. Sporæ oblongæ concatenatæ demum liberæ, mucro involutæ.

447. *M. atroviridis*. On dead leaves of grass, Batheaston, Dec. 1849.

Perithecia excipuliform, scattered, minute, quite smooth, formed of long closely-packed narrow cells. Sporophores filiform. Spores linear-oblong, concatenated, connected by a very delicate thread which frequently breaks off with them, containing one or more globose nuclei, generally one at either end, involved in gelatine forming a black green mass resembling strongly the fructifying stratum in the genus *Phallus*.

Closely resembling externally *Myrothecium gramineum*, Lib., but differing greatly in structure. The genus is allied to *Excipula*, but separated from it by habit, by the absence of flocci, and above all by its concatenate spores. The spores collectively are very gelatinous. We do not observe any distinct gelatinous coat to each spore, but infer the presence of a gelatinous medium from the extreme tenacity of the fructifying mass. The genus appears to be allied to *Catinula*, Lév.

PLATE XII. fig. 9. *a*. Plant nat. size; *b*. ditto magnified; *c*. portion highly magnified, showing the sporophores springing both from the walls and cellular base; *d*. spores magnified 340 diameters.

CYSTOTRICHA, n. g.

Perithecium rima longitudinali dehiscens. Sporophoræ ramosæ articulatæ submoniliformes hic illic sporis oblongis uniseptatis obsitæ.

448. *C. striola*. On decorticated wood, Batheaston. Probably very common.

Perithecia punctiform or linear, often forming little rows, black, with a reddish tinge, opening by a longitudinal fissure. Disc reddish. Sporophores highly developed, greatly elongated, bearing one or two branches above, articulate from the base submoniliform, the articulations about as long as broad, giving off here and there oblong pellucid spores, which are at first simple, but at length uniseptate.

This curious little plant has nearly the structure of *Tubercularia*, with the addition of a perithecium, the sporophores however being closely articulate. It resembles very much *Stictis parallela*, which has however distinct asci and sporidia as

represented by Corda and confirmed by ourselves. *Endotrichum* of Corda again has a close external resemblance, but a glance at the figure and description shows clearly that they cannot belong to the same genus. *Labrella punctum*, Corda, may also be compared with it. The extremely close external resemblance of objects belonging to as many very different genera would make a nice subject for amplification to those who adopt the notions prevalent with some of the transformation of species.

PLATE XII. fig. 10. *a.* Plant nat. size; *b.* ditto magnified; *c.* portion highly magnified; *d.* spores magnified 340 diameters.

449. *Coryneum compactum*, n. s. Minutum primitus tectum sero denudatum; sporis late fusiformibus obtusiusculis, nucleis concatenatis. On dead twigs of elm, Wraxall, Som., March 1845. It occurs also in Upper Carolina on *Betula rubra*.

Forming minute scattered pustules at first quite covered by the cuticle, at length exposed. Stroma convex; spores pedunculate, widely fusiform, slightly obtuse, 4-5-septate, nuclei large, connected with one another.

This species bears nearly the same relation to *Stilbospora pyriformis* that the next does to *S. angustata*. The nuclei are connected with one another after the fashion of the endochromes of *Sirosiphon ocellatus*, Kütz., *Sacothecium Corni*, Mont., *Helminthosporium Hoffmanni*, Berk. and Curt., and some others. The shape of the spores is very much that of the same organs in *Hymenogaster griseus*, Tul.

450. *C. disciforme*, Kze. Myc. Heft 1. p. 76. On dead twigs of birch, woods near King's Cliffe.

b. ellipticum, Berk. & Br. Magnum transversum; stromate elliptico crasso pulvinato, sporis pedunculatis multiseptatis fusiformibus; endochromatibus ut plurimum biguttatis. On trunks of birch-trees, King's Cliffe.

Bursting transversely through the bark, large, elliptic, pulvinate; stroma thick, white, black towards the edges, consisting of closely-packed elongated cells; spores fusiform, multiseptate; articulations slightly constricted; endochromes granular, containing generally two transversely arranged globules.

We were at first inclined to consider this a new species, but specimens exactly agreeing with Corda's figure have since occurred on smaller twigs, which exhibit occasionally two globules in the endochromes, and we now regard it merely as a very highly developed form.

451. *C. microstictum*, n. s. Tectum; stromate obsoleto; sporis minutis breviter lanceolatis 2-3-septatis. *Sporocadus rosicola*, Rab. no. 1166. On dead twigs of rose, vine, *Kerria japonica*, &c. Sent by Mr. Stephens, Mrs. Hussey, &c.

Scattered over the twigs and always concealed by the cuticle, which cracks in the centre of each little pustule. Stroma obsolete. Sporophores elongated; spores minute, brown, shortly lanceolate, with two or three septa.

This has very much the habit of an *Hendersonia*, but there are no perithecia. We cannot place it in *Stilbospora*, because the spores are not ejected as in the species of that genus. It is in fact just intermediate between *Stilbospora* and *Coryneum*. The spores vary slightly, but not sufficiently to justify the proposition of more than one species.

452. *Sporidesmium polymorphum*, Cord. Ic. Fasc. 1. fig. 119. On decorticated oak, Wraxall, Som., Feb. 1845, C. E. Broome.

Remarkable for its closely septate peduncle. Corda's specimens are on white birch.

453. *S. antiquum*, Cord. Ic. Fasc. 3. fig. 11.

Var. *compactum*, Berk. & Br. On hard wood, Wraxall, Som., C. E. Broome.

Our species agrees in general character with Corda's, of which we have a specimen from the author, but it is more compact and composed of smaller cells.

454. *S. pyriforme*, Cord. Ic. Fasc. 1. fig. 116. On decayed boards, Luciefelde, Shropshire, Rev. W. A. Leighton, July 1842.

Our species seems to be exactly what is figured by Corda, but we have no authentic specimen. It forms a thick crust-like stratum.

455. *S. melanopum*, Berk. & Br. Sporis subglobosis basi cellulosa suffultis, stratum e pluribus soris congestum efformantibus. *Spiloma melanopum*, Ach. Meth. t. 1. fig. 3; Eng. Bot. ! t. 2358. Common on the bark of apple-trees.

We are indebted to Mr. Borrer for authentic specimens. Forming broad black patches made up of many smaller spots. Spores subglobose, very opaque, apparently simple, but really composed of numerous cells supported by a cellular base, which varies much in length and breadth. In some specimens, but not in all, short articulated filaments occur, which seem to belong to a species of *Helminthosporium*.

456. *S. scutellare*, Berk. & Br. Soris scutellæformibus; sporis late obovatis cellulosis, basi brevi cellulosa suffultis. On larch-bark, Ulting, Essex, H. Piggot, Esq.

Sori scattered, minute, scutelliform; spores obovate, evidently cellular, springing from a cellular stroma and supported by a few variously arranged cells, which are sometimes reduced to merely one.

TETRAPLOA, n. g.

Sporæ nudæ ut plurimum 4-articulatæ quaternatim connatæ, quæque seta coronata.

457. *T. aristata*. On grass, Westhay Woods, King's Cliffe.

Forming a thin olive-black stratum, consisting of generally quadriarticulate oblong spores growing four together and perfectly connate, each crowned with an articulate seta as long as itself.

This most curious fungus has occurred once only. It is a compound *Sporidesmium*. The quadriaristate bodies may either be regarded as made up of four spores or as spores formed of four parallel rows of cells, each row being terminated by a bristle. They remind one strongly of the achænium of some Composite plant.

PLATE XI. fig. 6. Young and mature spores highly magnified.

457*. *Echinobotryum atrum*, Cord. Ic. Fasc. 2. fig. 6. Parasitic on some species of *Pachnocybe*, Milton, Mr. Henderson ; King's Cliffe.

The spores have the appearance of fascicles of minute perithecia.

458. *Dictyosporium elegans*, Corda in Weitenweber Beit. no. 1. p. 87 ; Cord. Ic. Fasc. 2. fig. 29. On barked oak-trees, Brockley Combe, Som., C. E. Broome, Feb. 1845.

Allied to *Sporidesmium*. A very curious and distinct production, of which we have specimens from the author.

459. *Coniothecium effusum*, Cord. Ic. Fasc. 1. fig. 21. Common on fence rails.

Possibly the barren state of some well-known fungus. This is probably *Lepraria nigra*, Eng. Bot.

460. *C. Amentacearum*, Cord. Ic. Fasc. 1. fig. 26. On dead willow-twigs : extremely common.

461. *C. betulinum*, Cord. l. c. fig. 25. On dead birch-twigs, King's Cliffe.

462. *Torula Sporendonema*, Berk. & Br. *Sporendonema Casei*, Desm. Ann. d. Sc. Nat. vol. xi. p. 246 ; Mougeot & Nestler, no. 998.

We have lately met at King's Cliffe with well-developed specimens of this species, which is precisely the plant of Mougeot and Nestler. It has exactly the structure of *Torula*, and certainly has not the spores contained within a tube. Corda's *Torula Casei* appears to be very different. A variety occurs on rats' dung. The rats had probably been robbing a cheese infested with the mould. The specimens came from Mr. Henderson.

463. *T. pulvillus*, n. s. *Cæspitibus pulvinaribus ; floccis compactis rectis ramosis ; articulis oblongis leviter constrictis*. On dead twigs of oak bursting in little tufts through the bark, Ape-
thorpe, March 1841.

Tufts cushion-shaped, half a line broad, compact, black ; flocci straight, slightly branched, often suddenly diminishing in size

and again incrassated, consisting of numerous slightly constricted oblong joints; endochrome containing a single nucleus.

Resembling somewhat in structure *T. stilbosporoides*, Corda, of which we have an authentic specimen, but differing greatly in habit.

464. *T. abbreviata*, Cord. Ic. Fasc. 1. fig. 130.

b. sphaerieformis, Berk. & Br. On dead stems of herbaceous plants, Apethorpe. On decorticated branches of *Pinus sylvestris*, Wraxall, Som.

Our specimens exhibit rather a different form from that figured by Corda. Instead of being widely diffused they present little Sphaeria-like tufts, and have a highly developed hyphasma, consisting of forked threads, at the apices of which the short chains of spores are fixed. The form of these is identical with what was observed by Corda, and we regard the species as the same with his, though constituting a distinct variety.

465. *T. basicola*, n. s. Hyphasmate repente ramoso hic illic assurgente; floccis fertilibus brevibus 5-7-articulatis fastigiatis; articulis non constrictis sero caducis, ultimo obtuso. At the base of stems of peas and of *Nemophila auriculata*, King's Cliffe.

Black, effused. Hyphasma creeping, branched, here and there rising from the general mass and giving off fascicles of short fastigiate fertile threads consisting of from 5-7 articulations. Articulations not constricted, ultimately separating, the last very obtuse. Each endochrome has usually a single nucleus.

A very curious species, distinguished from most *Torulae* by its articulations not being constricted. In the plant on *Nemophila* the fertile threads grow singly, but there is no other difference. It is either destructive of the plant on which it grows, or is developed on it in consequence of previous disease.

PLATE XI. fig. 4. *a.* Flocci with fructifying branches magnified; *b.* a mature fructifying branch and separate articulation highly magnified.

466. *Septonema spilomeum*, Berk. in Lond. Journ. Bot. vol. iv. t. 12. fig. 5. On old fence rails, Guernsey, Rev. T. Salwey.

The Guernsey specimens exhibit longitudinal as well as transverse septa, and are more transparent. They differ in no other respect, the proportions of the constituent parts being precisely the same. Mr. Salwey writes that the tufts are green when fresh. We have specimens from Upper Carolina in which the threads are still more opaque than in those from Ohio.

SPOROSCHISMA, n. g.

Flocci erecti simplices; membrana exterior inarticulata tenax; endochroma demum in sporas quadriarticulatas emergentes secedens.

467. *S. mirabile*, Berk. & Br. Gard. Chron. 1847, p. 540.

Brockley Combe, Som., Feb. 1845; Stapleton, Gloucestershire, C. E. Broome and G. H. K. Thwaites, on rotten beech wood.

Forming a black velvety stratum. Flocci erect, simple, tapering towards the base. External membrane tough, inarticulate. Endochrome breaking up into cylindrical quadriarticulate spores, at length escaping from the ruptured thread, each joint having frequently a single nucleus.

A most curious genus, which has also been found near Paris by Dr. Roussel. It is accompanied both in the French and English specimens by a species of *Helminthosporium*.

The affinities of this plant are clearly with *Torula*, the circumstance of the endosporous mode of fructification being apparent rather than real. The outer membrane is very tough, and does not break up into separate portions with the spores. The plant is in fact a *Septonema* inclosed in an additional membrane. There is occasionally a second inarticulate membrane, a structure calling strongly to mind some *Scytonemata*. The conidia of *Graphium penicillatum* are produced in the same way. See Bot. Zeit. 1847, t. 4. fig. 4. It should be mentioned that Dr. Montagne had independently of ourselves formed a new genus for this plant, which however he has waved in favour of the name given, though certainly without any sufficient character, in the Gardeners' Chronicle.

468. *Puccinia Rhodiola*, n. s. Maculis fuscis, soris congestis; sporis brevibus articulis depressis constrictis, quandoque subdivisis. Berk. in Gard. Fl. Forfars. p. 296. On leaves of *Sedum Rhodiola*, Glen Callater, July 1844, Mr. W. Gardiner.

Spots orbicular, traversed by the central nerve, brown. Sori minute, crowded. Spores shortly pedicellate, articulations depressed, sometimes spuriously subdivided, showing a tendency to the structure of *Triphragmium*.

469. *P. Smyrni*, Cord. Ic. Fasc. 1. fig. 67. On *Smyrniolum Olusatrum*, Penzance, J. Ralfs, Esq.

Remarkable for its coarsely tubercled spores.

470. *P. Umbilici*, Guépin in Dub. Bot. Gall. p. 890; Berk. Br. Fung. no. 329. On *Cotyledon umbilicus*, Penzance, J. Ralfs, Esq.; Guernsey, Rev. T. Salvey.

471. *P. Scrophulariae*, Lib. no. 193. On *Scrophularia aquatica*, Penzance, J. Ralfs, Esq.

472. *P. Campanulae*, Carm. MSS. On *Jasione montana*, Lampeter, J. Ralfs, Esq.

473. *P. coronata*, Cord. Ic. Fasc. 1. fig. 96. *Solenodonta graminis*, Castagne Cat. p. 202. t. 2. *Puccinia sertata*, Preuss in Deutsch. Fl. Abt. 3. no. 25. t. 3. On *Bromus giganteus*, Bangor, J. Ralfs, Esq.

We do not see how this differs generically from *Puccinia*. The

circumstance of the spores being multiapiculate instead of unia-
piculate surely cannot be of generic importance. At any rate
the name *Solenodonta* cannot stand, as it is preoccupied by a
genus of insectivorous mammals, Brandt in Mém. de l'Ac. d. S.
Pet. vol. ii. 1833, p. 459.

474. *Uredo Valerianæ*, D.C. Fl. Fr. vol. v. p. 68 ; Berk. Br.
Fung. no. 349. On *Valeriana officinalis*. Received from Berwick,
Suffolk, Bristol and North Wales.

475. *U. Symphyti*, D.C. Fl. Fr. vol. v. p. 87 ; Berk. Br. Fung.
no. 320. Audley End, Rev. J. E. Leefe, May 1841.

476. *U. Sempervivi*, A. & S. p. 126. On leaves of the com-
mon houseleek, Warwickshire, Rev. A. Bloxam.

477. *Lecythea Epitea*, Lév. Ann. d. Sc. Nat. Dec., 1847, p. 374.
Uredo Epitea, Kz. Myc. Hest 1. p. 68. On willows, North Wales,
J. Ralfs, Esq.

478. *L. mixta*, Lév. l. c. *Cæoma mixtum*, Lk. in Willd.
Lin. vi. P. 2. p. 40. On willows, Roscobie, Forfarshire, Mr.
W. Gardiner.

479. *Ustilago Montagnei*, Tul. Ann. d. Sc. Nat. Feb. 1847,
p. 88. t. 5. fig. 31. On *Rhyncospora alba*, Gamlingay, Prof. Hens-
low.

480. *U. typhoides* = *Erysibe Typhoides*, Wallr. Fl. Crypt. Germ.
vol. ii. p. 205. On stems of *Arundo Phragmitis*, which it mate-
rially injures, Fens of Cambridgeshire.

Forming thick bullate patches several inches long, occupying
whole internodes covered by their sheath ; spores globose, larger
than in *U. hypodytes* and *U. longissima*.

A very good account of this species will be found in Wallroth's
book quoted above. Our plant is exactly his species. It some-
times occupies distinct lines, as in *U. longissima*. Whether *U.*
grandis, Fr., be the same thing or not can only be ascertained by
the sight of authentic specimens.

481. *U. hypodytes*, Fr. Syst. Myc. vol. iii. p. 518. This spe-
cies occurred in 1848 in the greatest profusion at King's Cliffe,
affecting almost every flowering-stem of *Bromus erectus*. A plant
of this grass being set in a garden produced none but diseased
flower-stems the following year.

482. *U. Salveii*, n. s. Sori elongatis parallelis nigris ; sporis
obovatis granulatis. On leaves of *Dactylis glomerata*, St. Mar-
tin's, Guernsey, 1847 ; on hedge-banks, Rev. T. Salwey.

Forming elongated parallel sori on the upper surface of the
leaves. Spores four times as long as in *U. longissima*, obovate,
rough with minute granules.

A most distinct and interesting species, exhibiting in its spores
the type of an *Uredo* rather than of an *Ustilago*.

483. *U. grammica*, n. s. Minuta lineas breves parallelas in fascias transversas aggregatas efformans; sporis minimis globosis. On stems of *Aira aquatica*, Oxton, Notts.

Forming little transverse fasciæ, consisting of short parallel black lines a line or more in length. Spores globose, far smaller than in *U. longissima*, not exceeding one-third of their diameter.

This species appears to me to be quite distinct from *U. longissima*, with which it is associated by Messrs. Tulasne.

484. *U. vinosa*, Tul. Ann. d. Sc. l. c. p. 96. On the swollen receptacles of *Oxyria reniformis*, Forfarshire, Mr. W. Gardiner.

Spores smaller than in *U. utriculosa*, and merely minutely papillose instead of being reticulated.

485. *Polycystis Colchici*, Tul. Ann. d. Sc. Nat. Feb. 1847, p. 117. *Sporisorium Colchici*, Lib. no. 194. *Uredo Colchici*, Br. Fung. no. 309. On leaves of meadow saffron, Rudloe, Wilts, C. E. Broome.

486. *P. parallela*, Berk. & Br. *U. parallela*, Eng. Fl. vol. v. part 2. p. 375. *Uredo Agropyri*, Preuss in St. Deutsch. Flora, no. 25. t. 1. On rye, Mr. J. Sowerby; on the leaves of some *Carex*, Forfarshire, Mr. W. Gardiner.

487. *P. Viola*, Berk. & Br. *Granularia Viola*, Sow. t. 440. On leaves and especially petioles of violets. Druid's Stoke, Gloucestershire, Capt. Munro; Portland Island, C. C. Babington, Esq.

The spores in this curious species are more or less globose, consisting of several cells surrounded by a common irregular crust.

488. *Tuburcinia Trientalis*, n. s. Hypo-epiphyllum; soris bullatis nigris; sporis irregulariter depresso-subglobosis. On leaves of *Trientalis europæa*, Aberdeen, Dr. Dickie.

Sori two lines broad, bullate, containing a black mass of rather irregular depressed subglobose spores, which are very opaque and distinctly cellular. Hyphasma white, branched, creeping, delicate.

489. *T. Scabies*, Berk. Spor. globosis cavis hic illic lacunosis olivaceis. Berk. in Journ. Hort. Soc. vol. i. t. 4. fig. 30, 31. *Rhizosporium Solani*, Rab. no. 900. On potatoes: very common: often confounded with the true potato scab.

The spores of this species are very curious; they are composed of minute cells forming together a hollow globe with one or more lacunæ communicating with the external air. A hollow shell with one or two apertures will give a notion of their form. They are generally attached laterally by a delicate thread.

490. *Æcidium Galii*, Pers. Syn. p. 207. On leaves of *Galium verum*, Sands of Barrie, Mr. W. Gardiner.

491. *Isaria Friesii*, Mont. Ann. d. Sc. Nat. ser. 2. vol. vi. p. 28

(t. 12. fig. 3. *l. c.* vol. v.). On dead stems of *Syringa vulgaris*, ash, elder, &c., Milton, Mr. J. Henderson; Apethorpe, Norths., Spye Park, Wilts., flourishing in the middle of winter.

Sometimes pale gray, sometimes pale fawn-coloured.

492. *Stilbum fasciculatum*, n. s. Stipitibus flabellato-fasciculatis basi connatis cinereis, capitatis incarnatis; sporis ellipticis minoribus. On decayed wood, Swansea, M. Moggridge, Esq.

Stems gray, fasciculate, connate at the base, so as to form little flabelliform tufts. Heads flesh-coloured; spores elliptic.

This species has quite a tropical aspect, resembling somewhat the Brazilian *Stilbum stromaticum* and the South Carolina *S. Rhoidis*, but still more nearly *S. clavulatum*, Mont., from Surinam, and scarcely differing from a species which was produced abundantly in the Orchis house at Kew, except in having smaller, less oblong spores, and the base of the stems more decidedly connate. The Kew Garden species, which can scarcely however be considered indigenous, may be characterized:—

493. *S. vaporarium*, n. s. Stipitibus congestis fasciculatis basi plus minus connatis cinereis; capitulis incarnatis; sporis oblongis majoribus.

494. *S. fimetarium*, Berk. & Broome = *Helotium fimetarium*, P. Syn. p. 678. This species is not uncommon on cow-dung, rabbits'-dung, &c. It is certainly no *Peziza*, being destitute of asci, and approaches near to *S. erythrocephalum*, Dittm. Authentic specimens from Persoon show the identity of our plant.

495. *Periconia glaucocephala*, Corda, Ic. Fasc. 3. fig. 37. On rotten linen, King's Cliffe, 1841.

**Periconia discolor*, Corda, *l. c.* fig. 38, appears to be the same with *Pachnocybe grisea*, Eng. Fl. vol. v. part 2. p. 334. Splendid specimens of *Phycomyces nitens*, Ag., have lately been sent to us by Dr. Badham which we have propagated, and have consequently been able to watch the growth of the plant from its first appearance. It is a true Mucor, and certainly the prince of the genus.

**Volutella ciliata*, Fr. = *Psilonia rosea*, Berk. Eng. Fl. *l. c.* p. 353.

**Chaetostroma Buxi*, Cord. = *Fusisporium Buxi*, Fr. Syst. Myc. vol. iii. p. 447. These two species are decidedly congeneric, as are also *Aegerita setosa*, Grev. t. 268. fig. 2, and *Psilonia hyacinthorum*, Berk. *l. c.*

The older name of *Volutella* must be retained for them. We have therefore *Volutella ciliata*, Fr., *V. Buxi*, *V. setosa* and *V. hyacinthorum*, belonging to the list of British Fungi, and the following new species:—

496. *V. melaloma*, n. s. Stromate aurantiaco; pilis atris; sporis breviter fusiformibus leviter lunatis appendiculatis. With *Neotiospora Caricum*, Spye Park, C. E. Broome.

Perfectly superficial. Stroma and spores bright orange, fringed with black articulated hairs. Spores shortly fusiform, slightly lunate, resembling, except in the latter character, those of *Neotiospora*.

It is most singular that a plant so different in general structure, though alike in colour and spores, should exist upon the same leaf with *N. Caricum*. In the present state of our knowledge of such matters we must regard it as distinct, though we cannot help suggesting the idea that the perithecium in the one is represented by the ciliating hairs in the other, a structure which was pointed out by one of us as a matter of analogy between *Sphaeronema blepharistoma*, Berk., and *Volutella Buxi*, many years since. What makes the resemblance more striking in the present instance is that the spores in either case grow in the same mode from the stroma, which inclines to a globose form.

PLATE XI. fig. 3. *a*. Portion of plant showing the hairs and stroma with the sporophores and spores, magnified; *b*. spores highly magnified.

497. *Illosporium carneum*, Fr. Syst. Myc. vol. iii. p. 259; Berk. Br. Fung. no. 293. On *Peltidea canina*, Apethorpe, Norths.

498. *I. corallinum*, Rob. in Desm. no. 1551. On *Borreria tenella*, Ulting, Essex, H. Piggot, Esq.

A beautiful specimen of this exquisite species has been just transmitted to us from Chelmsford without any distinct locality. This is clearly *I. coccineum*, Libert, and consequently of Corda.

499. *I. coccineum*, Fr. l. c. On *Pertusaria communis*, Fal-mouth, Miss Warren; Durdham Down, G. H. K. Thwaites, Esq.

500. *Epicoccum neglectum*, Desm. no. 540 (olim *Perisporium Zeæ*). On a decayed water-melon, King's Cliffe, Oct. 1840; on dead plants of *Potamogeton*, West of England, C. E. Broome, 1850.

At first sight our earlier specimen differs greatly, the stromata being seated on a broad blood-red spot, but the structure is exactly the same, and the greater development of the spot may depend upon the more juicy nature of the matrix. *Uredo Equiseti*, Engl. Fl., is an *Epicoccum* with smooth spores, but we have not at present sufficiently good specimens to propose it as a new species.

501. *Ædemium atrum*, Corda in St. Deutsch. Fl. Fasc. 6. t. 9. On fallen branches, King's Cliffe, Capel Curig, M. J. Berkeley, and at Thame, Dr. Ayres.

The structure of this plant is at present very imperfectly ascertained. The flocci are of a vinous-brown, and here and there invested with mucilage. The larger sporangiiform bodies which adhere to them seem very much to resemble an *Epicoccum* with its globose or somewhat obovate scabrous spores.

XLI.—On *Hyoscyamus* and *Physochlæna*.

By JOHN MIERS, Esq., F.R.S., F.L.S.

HYOSCYAMUS.

I AM induced to offer a few remarks, and propose an emended character for this genus, in order to confirm some observations made on a previous occasion (*huj. oper.* iii. 174). Although the opercular dehiscence of the capsule of *Hyoscyamus* has long been notorious, the fact of a glandular enlargement on the summit of the ovarium does not appear to have been anywhere described: it is however a circumstance worthy of consideration in a physiological point of view, and leads us to inquire what is its true nature. In the ovarium of *Hyoscyamus pictus*, which I examined in a living state, this glandular appendage is seen to form a very distinct, thick, and fleshy covering over its larger superior moiety, where it is terminated by a decided margin, and as the ovarium advances towards maturity, the lower portion increases considerably in bulk, the pericarpial envelope being drawn out to a thin membranaceous tube, marked with numerous longitudinal and branching nervures, while the upper thickened moiety increases but little in length: these longitudinal nervures may be distinctly traced upon the inner lining from the base to the summit of the cell, while upon the external face they are visible only on the lower portion, no trace of them being seen upon the glandular moiety, which exhibits quite a different texture, proving beyond all doubt that the glandular coating in question is really superimposed, and forms no part of the endocarpial lining, and therefore that it is not an interior secretion within the cavity of the cell. It is evident that the lower half of the ovarium consists of two cohering integuments with little or no intervening substance; for when the fruit is ripe they are seen to be really distinct, and may without difficulty be separated from each other on their lacerated edges: but in the upper moiety the remarkable fleshy gland before mentioned is seen to be interposed between the continuation of these two integuments, and as it hardens by the deposition of woody matter it constitutes the well-known operculum, which forms quite an external mushroom-headed enlargement, and which falls off, not by a regular dehiscence, but by a ruptured edge, as is proved by the lacerated margin of the two integuments upon the circumscissile line. The nature and purport of this apical gland do not appear manifest; it is probably an extension from the base of the style, for the epicarpial integument terminates at the summit of the ovarium by a small ring, that forms an apparent articulation with the style, which on the contrary is continuous

with the gland in question, this being evident upon making a longitudinal section just before the ripening of the fruit.

Dr. Putterlick has given in Nees's 'Gen. Pl. Germ.' a very good series of illustrated analytical dissections of the flower and seed of *Hyoscyamus*, but in many respects these details do not agree with the structure, as I have observed it; for instance, the placentæ are represented as being cruciform with the dissepiments, to which they are attached by a central axile line, becoming lunately expanded in the middle of each cell as in *Physalis*; I have found the placentæ on the contrary to be thick and fleshy, both closely adnate with the dissepiment, forming one cylindrical column that fills the greater portion of the central space of the ovarium; the embryo is also shown too thick in proportion, and the cotyledons are not incumbent as there exhibited, but accumbent after the manner almost universally seen in this family: some of the figures there truly represent the corolla as having an imbricated æstivation, which however is erroneously described in the text, as in the descriptions of all other authors, as being plicated: there is no indication there represented of the remarkable apical gland in the summit of the ovarium.

I have annexed the specific character of a species which I found growing in Kew Gardens, and which appears nowhere given.

HYOSCYAMUS, Tournef.—*Calyx* urceolato-tubulosus, 10-nervis, 5-dentatus, dentibus erectis demum rigidis, persistens et augescens. *Corolla* infundibuliformi-campanulata, obliqua, imo constricta, limbi obliqui lobis 5, brevibus, obtusiusculis, subinæqualibus, patentibus, sæpe hinc semi-fissa, æstivatione imbricata. *Stamina* 5, imo corollæ inserta, inclusa, rarius exserta, declinata; *filamenta* imo fornicata et puberula, superne subulata et glabra; *antheræ* 2-loculares, loculis arete adnatis, longitudinaliter intus dehiscentibus, imo connectivi dorsalis articulatim affixæ. *Ovarium* conicum, disco hypogyno fere obsoleto impositum, glandula apicali magna crasso-carnosa signatum, 2-loculare, pluri-ovulatum, placentis valde incrassatis dissepimento utrinque adnatis. *Stylus* exsertus, apice incurvus. *Stigma* capitato-bilobum. *Capsula* urceolata, submembranacea, calyce aucto reticulato-coriaceo dentibus pungentibus recondita, 2-locularis, supra medium horizontaliter ruptilis, operculo deciduo, cupuliformi, crasso, corneo. *Semina* reniformi-ovata, compressa, *testa* scrobiculata, *hilo* prominulo cavo in sinu laterali. *Embryo* in *albumen* carnosum teres, subspiralis, *radicula* paulo incurvata, ad angulum basalem spectante, *cotyledonibus* semiteretibus æquilonga.—*Herbæ Gerontogææ pubescentes, sæpius viscosæ et olidæ, radice perennante; folia*

alterna, dentata, vel sinuato-angulata, floralibus sæpe geminis; flores axillares, solitarii, secundi; corolla lutescens, sæpe reticulatim picta.*

Hyoscyamus pictus, Bernh. MSS.;—viscido-pilosus, foliis ellipticis, acutis, sub-3-lobis, infra medium sæpe repandis, vel sinuatis, subamplexicaulibus, rachi, nervis, margineque lanato-pilosis; flore breviter pedunculato, caule, pedunculo, calyceque pungente imo ventricosso lanato-pilosis, corolla ventricosa, glabra, sulphurea, venis violaceis reticulatim picta, ad ventrem subfissa, intus imo maculis magnis 5 violaceis ornata, limbi lobis subæqualibus obtusis, filamentis luteis, antheris violaceis inclusis.—*v. v. cult.*

PHYSOCHLÆNA.

The plants composing this small group were for a long time considered as species of *Hyoscyamus*. Mr. G. Don (Dict. iv. 470) was the first to separate them as a distinct genus, on account of their entire leaves and their terminal corymbose purple flowers, but as in his generic character no feature appeared to indicate any difference from *Hyoscyamus*, either in the structure of the flower or the fruit, they have been retained in this latter genus by all succeeding botanists. M. Decaisne in describing an Indian species perceived the difference of its habit from that of *Hyoscyamus*, and adopted it as the type of a new genus, under the name of *Belenia*, but this suggestion has in like manner been disregarded. I have noticed however the following circumstances that seem to warrant the restoration of this genus. In *Physochlæna* the apical gland is proportionally much smaller and far less conspicuous than in *Hyoscyamus*, for the ovarium being more conical, it covers only the extreme upper portion beneath the base of the style, and is distinguishable from the rest of its surface by its lurid purple colour: it offers also a larger and more conspicuous hypogynous, fleshy, yellow disc, which is sometimes scarcely discernible in the other genus. Besides these points of variance, and the dissimilarity in habit, as well as in the colour of its corolla, the following differences are evident. In *Hyoscyamus* the flowers are always axillary, nearly sessile at the base of a large leaf, and generally secund; the calyx increases very considerably in length, becomes stiff and rigid, and its teeth, conspicuous for their strong marginal nerves, ending in a long mucronate point, become hard and spiculate, and are always somewhat spreading; the operculum is convex, nearly hemispherical, and of a bony consistence. In *Physochlæna*, on the contrary, the flowers are never axillary, but always upon a more or less lengthened ter-

* Analytical details of this genus will be given in a supplementary plate in the 2nd vol. of the 'Illustr. South Amer. Plants.'

minial raceme or panicle; the calyx does not increase to half the size, in proportion to that of *Hyoscyamus*, it is more reticulated, of thinner and more membranaceous texture, and the teeth, wanting the strong marginal nervures, are thin and blunted, and generally inflexed, nearly closing the mouth of the tube; the operculum is also much smaller, quite flat and discoid, and less bony in its substance. These different features are fully sufficient to constitute a valid genus, which I propose to call *Physochlæna*, a name more strictly in conformity with the usual orthoëpy than that of Don, being derived from $\phi\upsilon\sigma\alpha$, *vesica*, $\chi\lambda\alpha\iota\nu\acute{o}\omega$, *vestio*, because of its capsule inclosed in a vesicular calyx. I here annex its generic outline:—

PHYSOCHLÆNA. *Physoclaina*, G. Don. *Belenia*, Decne.—*Calyx* cylindricus, sæpe medio subinflatus, 10-nervis, 5-dentatus, persistens et augescens. *Corolla* campanulato-infundibuliformis, superne ventricosa, imo constricta et cylindrica, limbo vix obliquo, subæqualiter 5-fido, lobis subacutis, haud patentibus, æstivatione imbricata. *Stamina* 5, subæqualia, declinata, sæpius exserta, in constrictionem corollæ inserta, *filamenta* ortu pilosa, superne glabra, colorata; *antheræ* ovatae, imo dorsi ad connectivum articulatim affixæ, 2-loculares, loculis adnatis, margine longitudinaliter dehiscentibus. *Ovarium* conicum, disco carnosio annulari basi cinctum, glandula parva apicali vix conspicua munitum, 2-loculare, ovulis plurimis, placentis valde incrassatis, dissepimento utrinque adnatis. *Stylus* incurvus, exsertus. *Stigma* subbilobo-capitatum. *Capsula* turbinata, membranacea, calyce reticulato inclusa, 2-locularis, apice operculatim dehiscens, operculo parvo discoideo, coriaceo. *Semina* plurima, placentis crassis affixa, ovata, compressa, reniformia, *testa* reticulato-favosa, *hilo* laterali. *Embryo* teres, intra *albumen* subcarnosum hemicyclius, *radicula* incurvata, ad angulum basalem spectante, cotyledonibus semiteretibus æquilongis.—*Herbæ Gerontogææ Orientales*, radice *perennante*, caulibus *plurimis*; folia *elliptica*, *alterna*, *integra*, *petiolata*; flores *terminales*, *corymbosi*, *pedicellati*; corolla *purpurascens*, *rarius sublutescens*.

1. *Physochlæna physaloides*. *Physoclaina physaloides*, G. Don, *Dict.* iv. 470. *Hyoscyamus physaloides*, Linn. *Amæn. Acad.* vii. tab. 6. fig. 1; *Sims, Bot. Mag.* tab. 852; *Sweet, Br. Fl. Gard.* i. tab. 13;—radice tuberoso, caulibus plurimis erectis, simplicibus; foliis subcordato-ovatis, acutis, imo in petiolum canaliculatum æquilongum attenuatis, utrinque glaberrimis, margine ciliatis; panicula terminali, pedicellis calycibusque dense lanato-pilosis; corolla omnino glabra, purpurascens, laciniis obtusis, albescentibus, genitalibus faucem vix exceden-

tibus; calyce fructifero inflato, glabro, capsulam dimidio minorem claudente.—Siberia, in montibus Altaicis, et planitiis Songariæ.—*v. s. in herb. Hook. e locis citatis.*

This plant scarcely exceeds the height of 6 or 8 inches, and may at once be distinguished from all others by the smallness of its leaves, and of its stature and its tuberose root: its leaves are $\frac{3}{4}$ inch long and 7 lines broad; they are subcordate or auriculate at base, tapering suddenly, and decurrent on the petiole of equal length. The flowers are capitato-corymbose; the pedicels and calyx are clothed with long cottony hairs, which are articulated, but apparently not viscous; the calyx is 3 lines long, the corolla 6 lines, the former growing to a length of 8 lines, being 3 lines broad in the mouth, and 5 lines diameter in the swollen middle; it is of transparent texture, smooth, marked with numerous reticulations, and with ten longitudinal nervures; the berry is about 3 lines in diameter, subglobose, with a small flattened operculum.

2. *Physochlæna Dahurica*;—caule violascente, foliis deltoideo-ovatis, acutis, basi auriculato-cordatis, hinc subito acuminatis, et in petiolum crassum decurrentibus, rachi venisque purpurascens, utrinque glaberrimis; panicula terminali, lanatopilosa, genitalibus inclusis.—Dahuria, *v. s. in herb. Hook.* (*Hyoscyamus physaloides, Turczaninow*).

This plant differs from the preceding in its more fleshy habit, its leaves being much larger, more deltoid, more acute at the apex, broader at their base; they are $1\frac{5}{8}$ inch long, $1\frac{3}{8}$ inch broad, on a fleshy petiole $1\frac{1}{2}$ inch long.

3. *Physochlæna rubricaulis*. *Hyoscyamus physaloides, Sweet, Brit. Fl. Gard.* i. tab. 12;—caulibus crassis, subprostratis, subflexuosis, rubescentibus, nodis cupularibus cum petiolo articulatis; foliis oblongo-ovatis, acutis, repando-undulatis, basi obtusis, in petiolum crassum canaliculatum longe decurrentibus, utrinque glaberrimis; racemo corymboso, terminali rufescente, paucifloro, pedicellis incurvis, calycibusque fuscis dense glanduloso-pilosis, corolla glabra, purpurascens, laciniis ovatis, rotundatis, staminibus inclusis, stylo declinato exserto recurvo.—*v. s. in hort. Kew. cult.*

This plant has a fusiform root: its stems are fleshy, somewhat flexuose, with internodes seldom more than half an inch apart; its leaves in shape much resemble those of *P. Dahurica*; they are 2 inches long, $1\frac{1}{4}$ inch broad, gradually tapering upon a fleshy petiole $1\frac{1}{2}$ inch in length; this as well as the thick fleshy midrib and prominent nerves are of a dark reddish purple colour; in drying, the blade of the leaf becomes yellow. Its inflorescence is much shorter, fewer-flowered, and covered with dense short

viscous down, not long woolly hairs, and its flowers are not corymbose and many-flowered. The calyx is 4 lines long, 2 lines in diameter; the corolla is 7 lines long, of a reddish purple colour, and its lobes are more ovate and rounded; the ovarium is glabrous. It makes its appearance at least a month or six weeks later in the season than the two following species*.

4. *Physochlæna orientalis*. *Physoclaina orientalis*, G. Don, *loc. cit.* *Hyosecyamus orientalis*, Bieb. *Fl. Taur.* i. 164; Sims, *Bot. Mag.* tab. 2414;—viscoso-pubescent, foliis fusco-iridibus, deltoideo-ovatis, acutis, in petiolum sublongum attenuatis, demum subglabris; floribus corymbosis, corolla obscuriore, purpurea, staminibus atro-violaceis, styloque æquilongo longe exsertis, calyce florifero tubuloso, fructifero cylindrico, membranaceo, reticulato, capsulam minorem includente.—Caucasia prope Narzanam: *v. s. in herb. Hook.* (Caucasus, Steven) *et in hort. Kew. cult.*

This plant grows in the open air in Kew Gardens to the height of 12 or 18 inches, its numerous stems being annually deciduous: it is altogether covered with short viscous pubescence, which, as well as the foliage, is of a dark fuscous hue, becoming greener after the fall of the flowers. The leaves are $2\frac{1}{2}$ inches long, $1\frac{1}{4}$ inch broad, upon a fleshy channeled petiole of 1 inch in length, the nervures and stem being of a purplish hue: the calyx is 3 lines long, the corolla 6 lines, the stamens and style being exerted to a length of 3 lines: the capsule is 3 lines in diameter, inclosed in the calyx of equal diameter, and of nearly double its length, which is pilose, reticulate, submembranaceous, and in no degree swelling in the middle: the lower valve of the capsule is somewhat membranaceous, greenish, and marked with several longitudinal nervures; the operculum, crowned by the persistent base of the style, is of a blackish violet hue, soft, of thin texture, and quickly shrivels up in drying: the seeds are few, proportionately rather large, yellowish brown, serobiculated, oval, reniform and compressed: the embryo is arched in a semicircular form; the radicle, about the length of the cotyledons, points to the basal angle below the lateral hilum.

- Var. β . *affinis*. *Hyosecyamus orientalis*, Sweet, *Brit. Fl. Gard.* i. tab. 12;—glanduloso-pubescent, foliis ovatis, acutis, in petiolum sublongum attenuatis, venis pilosulis, denum subglabris; corolla purpurascens, lobis subalbidis, staminibus inclusis, stylo longe exserto, calyce fructifero inflato.—*v. r. cult in hort. Kew.*

* A drawing of this species with analytical details will be given in a supplementary plate in the 2nd vol. of the 'Illustr. South Amer. Plants.'

This plant grows by the side of the former species, and little or no difference is to be seen between them in the size and shape of the leaves: they are however less fuscous, and do not become so thick and dark in drying, the pubescence is less dense, and the nervures beneath are prominent and green. The inflorescence is panicular, not corymbose; the pedicel, as well as its small sessile ovate pointed bract, and the calyx, being covered with dense, short, patent, glandular hairs: the corolla, of a pale purplish colour, is slightly pubescent externally; its æstivation is distinctly imbricate, with its external lobe on the contrary side to the more oblique portion, to which the stamens and style are inclined; the ovarium exhibits several long simple hairs upon its surface.

5. *Physochlæna præalta*. *Belenia præalta*, Decne. *Jacq. Voy. Bot.* 114. tab. 120. *Hyoscyamus præaltus*, *Walp. Rep.* iii. 21;—herba perennis, pilis brevibus rarisque viscidulis tota inspersa, foliis e parte infra medium lanceolatis, imo deltoideis, subiter acuminatis, et in petiolum incrassatum decurrentibus, supra glabris, subtus rachi crassissimo, et in venis prominentibus viscidulo-pilosis; panicula terminali, elongata, ramosa, ramis longis, laxiflora, pedicellis calyce longioribus, bracteatis, cernuis, demum elongatis, erectis; calyce brevi, urceolato, dentibus 5 brevibus reflexis, fructifero valde aucto, et subincurvo; corolla viridi-lutescente, venis viridibus picta.—Himalaya.

This plant appears much taller than any of the foregoing species, its inflorescence much longer and more lax, the calyx grows to a larger size considerably, and the corolla is of a greenish yellow, marked with dark green reticulations, as in *Hyoscyamus*. It approaches *Hyoscyamus muticus*, which probably belongs rather to this genus, on account of its long, panicular, terminal inflorescence, the obtuse lobes of its calyx, and often purple flowers. The leaves are $3\frac{3}{4}$ inches long (exclusive of its decurrent petiole of $\frac{1}{2}$ an inch), and $1\frac{1}{2}$ inch broad. The inflorescence is 7 or 8 inches long; the corolla is more campanular than that of the typical species, the stamens being included; the style alone is exerted: the calyx in flower is 4 lines long, tubular, and 2 lines in diameter; it subsequently grows to a length of 11 lines and to a diameter of 4 lines. In the drawing above quoted, a section is given of the seed of this species, in which there appears a manifest error in the relative positions of the radicle and cotyledons in regard to the hilum: it seems very unlikely that it should differ in this respect from the features described in the generic character, which are derived from careful observation upon several other species, and which are conformable to the structure known to exist in all the allied genera in this family.

XLII.—On the genus *Waltonia*. By THOMAS DAVIDSON, Esq.

[With a Plate.]

M. BOUCHARD and myself, in Jan. 1848*, published a detailed description of the genus *Magas*, Sowerby, with figures illustrating the internal structure of this remarkable little shell, at that period incompletely known. Some time after I wrote a paper† with figures on a recent species known under the name of *Terebratula rosea*, which shell, from the peculiar arrangement of its internal organization differing from that of all known Brachio-poda, led me to propose for it a distinct generic name, that of *Bouchardia*, belonging to the family of *Magasidæ*; *Magas pumilus* and *Bouchardia rosea* being the only species in each genus. During a late visit to Paris, M. Valenciennes kindly lent me specimens of recent *Terebratulæ* brought to Europe by Quoy and Gaimard; and on a tablet on which were placed several specimens of *Terebratula sanguinea*, Leach, I found a small shell whose organization was completely different from those with which it was surrounded, but offering characters not allowing of its being placed in either *Magas* or *Bouchardia*, but claiming a new generic name, and forming part of the family of *Magasidæ*. M. D'Orbigny, in his 'Pal. Franç. Ter. Crétacés,' vol. v. p. 52, places in this family *Magas* and *Terebratulina*; I cannot however agree with that author in this association, as I consider the organization of *Ter. Caput serpentis* to be completely different from that of *Magas*, and not to belong to the same group or family. In a very interesting paper by Mr. King‡ on certain genera of Palliobranchiata, the internal organization of *Terebratula rosea* is alluded to; and in the great work by that author on the Permian fossils of England, Mr. King has adopted and placed in the same family of *Magasidæ* the genus *Magas*, Sow., and my *Bouchardia*.

GENUS WALTONIA.

Char. Shell bivalve, inequivalved, equilateral, subovate, slightly convex; beak almost straight, partly truncated by a large foramen extending from the summit to the umbo of the ventral valve which it partly encircles; deltidium small, disunited, and forming only a portion of the peduncular opening: at the base of the beak are two strong teeth corresponding with the sockets of the ventral valve. The interior of the dorsal valve is simple, with a slight central longitudinal elevation dividing the shell into two equal portions, not extending quite to the margin. In the ventral valve

* Bull. Soc. Géol. de France, vol. v. 2nd series, p. 139, pl. 2.

† *Ibid.* vol. vi. 2nd series, 1849.

‡ Annals and Mag. of Nat. Hist. vol. xviii. 1846.

a strong elevated central plate arises near the umbo, describing a gentle curve, diverging more obliquely again, and by another curve attains the central ridge of the dorsal valve on which it rests, and from whence it descends, forming a gentle diagonal line to the bottom of the ventral valve. From the inner edge of both the dental sockets of this valve a ribbon-shaped lamella by a gentle curve rises to near the middle of the central plate to which they are attached.

Obs. From the inspection of this shell it will be seen, that by its beak, foramen and teeth it differs considerably from *Magas* and *Bouchardia*. In the last-named genus the foramen is completely surrounded by the substance of the shell and separated from the umbo of the ventral valve, without deltidium, while in *Waltonia* the position of the foramen, deltidium and umbo are exactly similar to that of the genus *Terebratulina*, D'Orb.: it approaches also more to *Magas* by the simplicity of its hinge. Besides these particular family characters we find the same calcareous support, and the same central elevated plate, but more simple in its details. In *Magas*, besides the two ribbon-shaped lamellæ described, we find two upper anchor-shaped lamellæ situated parallel to the under ones: these are not to be seen in *Waltonia*, which has only one pair; while in *Bouchardia* the under ones are completely wanting, and we find only the upper or anchor-shaped pair. Thus *Magas* would be characterized by two pair of lamellæ, *Waltonia* by the lower ones only, and *Bouchardia* by the upper ones. In all three the dental portion and foramen vary. The punctuation also is less strong in *Waltonia* than in *Magas*, and more so than in *Bouchardia*.

On these important differences I think myself authorized to propose for this little shell a distinct generic title, and I take much pleasure in dedicating it to my old friend William Walton, Esq. of Bath.

Waltonia Valenciennesii, nob. Pl. XV. fig. 1:

Shell small, of a red colour, ornamented by irregular costæ or undulations disposed as in *Ter. fimbria*, the central costæ being directed towards the umbo, but extending only from the margin to about half the length of the valve. The lateral costæ, instead of being directed towards the umbo as in all plicated *Terebratulæ*, diverge in a sloping manner towards the middle of the shell, and consequently could never reach the umbo (see figures). The dorsal valve is more convex than the ventral one, which is almost flat, with two ears similar to those visible in *Terebratula Caput serpentis*, &c.; foramen large. Length $2\frac{1}{2}$ lines, breadth 2 lines, depth 1 line; from the seas of New Zealand, where Quoy and Gaimard discovered it.

I dedicate this species to M. Valenciennes, whose talents and associations with Lamarck and Cuvier place him in the first rank among our European scientific men.

The only specimen known belongs to the Garden of Plants; and in order to illustrate the distinctions between the three genera of this small family, I have given in Pl. XV. profile views of *Magas* (fig. 2), and *Bouchardia* (fig. 3), which thus express to the eye what the writer of this paper has been unable to describe.

Fig. 1 is the natural size of *Waltonia Valenciennesii*; the other figures are enlarged.

I have also here to express my thanks to my old friend M. Bouchard, to whom I exposed my views on this new genus, and in which he completely concurred.

XLIII.—*On the Operculum of Gasteropodous Mollusca, and an attempt to prove that it is homologous or identical with the second Valve of Conchifera.* By J. E. GRAY, Esq., F.R.S.

To the Editors of the Annals of Natural History.

GENTLEMEN,

HAVING for several years entertained the opinion that the operculum of Gasteropods is identical with the second valve of bivalve shells, and having in the 'Synopsis' of the British Museum for 1842, and in several papers on Mollusca, mentioned it in that light, without any naturalist having attempted in any way to dispute the theory, I was induced to believe that it had been adopted as an axiom; but having lately mentioned the fact in the presence of Mr. Owen and several other comparative anatomists, and finding that they were not prepared to admit the propriety of the comparison, I have been induced to put on paper the reasons which led me to adopt the theory, which I have neglected to do before. I am the more induced to do so, as on reading Professor Lovèn's paper, I find that that very accurate and profound malacologist, who has paid much attention to the relation which the different classes of Mollusca bear to each other and the homologies of the different organs, though he has observed that these Mollusca are provided with a particular part, before very generally overlooked, which he calls the *lobus operculigerus*, but which I have long ago described as the mantle of the operculum, yet considers the operculum as analogous to *byssus*. His observations are as follows:—

"The Gasteropods have also another part of the foot, which may be named *lobus operculigerus*, sometimes highly developed

as in *Atlanta*, sometimes very reduced ; on its middle the *byssus* is secreted, whose filaments when present are always united into a disc-like *operculum*.

“ The side part of the lobe is sometimes produced into cirri, as in *Rissoa*, *Lacuna*, &c., sometimes into a large extensible membrane capable of covering the whole shell.”—*Lovèn, Ofvers. Kongl. Vetensk. Akad. Fork. 1847.*

In a paper on the Structure of Shell in the Philosophical Transactions for 1833, I showed with considerable detail that the operculum of the Gasteropodous Mollusca, like the shelly valve of those animals,

1. Is developed on the embryo long before it is hatched.

2. That it is placed on and covers a peculiar part of the body, which bears the same relation to it as the part of the body called the mantle bears to the part usually called the shell of these animals ; and it is formed and increased in size by an opercular mantle in the same way as the shells are.

3. That the operculum is more or less conical, and is increased in size by the addition of new matter to the inner surface, and especially to the surface near the margin ; the new matter either forming more or less complete rings round the nucleus (or first-formed part), when they are called *annular*, and are homologous to the simply conical shell, as the *Patella* ; or else the new matter is deposited almost entirely on one edge of the nucleus, when the operculum forms a more or less elongated cone, which, when long, is spirally twisted round an imaginary axis (like a spiral shell), the broad part of the cone being next the edge of the opercular mantle which secretes the new matter for enlarging its size, as the mouth of the shell is on the outer edge of the mantle of the univalve shell.

4. That the operculum is attached to the animal by means of one or more muscles, which, as in the bivalve shell, pass from the larger valve or shell to the smaller one or operculum.

5. The operculum as it increases in size is gradually moved on the end of the muscle ; the many-whorled operculum of the *Trochi* revolves as many times on the end of the muscle, as the many-whorled spiral shell turns on its imaginary axis.

6. The operculum is moulded on the opercular mantle, and is often lined internally with a shelly coat like a shell ; and sometimes, like the shell of the Cowries, it has its outer surface covered with a shelly coat deposited by some special development of the opercular mantle especially destined for the purpose, as is the case in the Cowries and some other shells.

From these observations it would appear, that the *operculum* has all the characters of the part of the animal which has been usually considered as the shell.

In the paper before referred to, I stated, "The operculum agrees with the valve of shells in being developed on the embryo while included in the egg, and in increasing in size by the addition of new matter round the circumference of the base of the cone of which they are formed. They also agree in the cone being sometimes simple and straight, and sometimes curved into a spiral form." The principal difference between the operculum and the valve or shell of the Gasteropods consists—

1. In the operculum having no cavity, the cone of which it is formed being either very much depressed, so as to become nearly flat or even concave, as in the annular or subannular operculum; or very much compressed, forming only a spiral riband, as in the spiral operculum.

2. The operculum of by far the greater number of Gasteropods is only formed of animal matter, so that the operculum is as if formed entirely of what constitutes the periostraca or *drap marin* of the shelly valves; but the shells of some Gasteropods, as that of the *Aplysia*, *Bullæ*, and of some land mollusks, and the valves of some bivalves, as *Lingula*, have only a very thin shelly internal layer, strengthening the thick periostraca; on the other hand, many opercula, like the generality of shells, have a shelly coat deposited on the inner side of the horny or periostracal coat, and others have the outer surface of this part, like *Cypræa* and some other genera of shells, covered with a shelly coat.

The absence of a cavity is a difference only of degree, for the valves of some Gasteropods, as *Umbrella* for instance, are so flat as to produce no cavity, and thus greatly resemble the annular opercula of *Ampullaria* and *Paludina*, as the flat valves of some *Calyptræ* are like the spiral opercula of *Littorinæ*; but the greatest resemblance is to be observed in the small flat valves of *Gryphæa*, *Exogyra*, *Chama*, and other genera of bivalve shells which are attached by one of their valves. These valves are often quite as flat and destitute of any cavity as the operculum of any Gasteropod; and it is to be remarked that these valves exactly resemble a spiral operculum in shape, the remains of the ligament forming a spiral mark on the outer surface, showing how the valve has rotated on the body of the animal as the operculum rotates on the foot of the Gasteropods.

Having thus shown the reasons which induced me to regard the operculum to be a modification of the other or shelly valve of a Gasteropod mollusk, I shall now proceed to show why I have been induced to believe that it is analogous to the second valve of a bivalve.

In the Philosophical Transactions for 1833 I remarked, "A bivalve shell is composed of a dextral and a sinistral valve united together by a ligament. When the two valves are separated and

spread out on a table, with the umbones above and the front end towards the observer, the valve to the right (the left when on the animal and in its usual walking position) resembles a dextral, and that on the left a sinistral, very depressed, spiral shell. This is well illustrated by comparing the left valve of an *Isocardia* with a *Concholepas*.

"In some very rare instances these shells also are reversed, but the fact is not easily observed except in the unequal-valved kinds. There were formerly in the Tankerville collection (they are now in the Museum) two specimens of *Lucina Childreni*, in one of which the right valve was a dextral shell in opposition to the general structure. A much more remarkable variation is to be observed in some of those bivalve shells whose under valve is attached to foreign bodies; thus for example, most of the *Chamæ* are attached by their left valve, but some species, such as *Chama Lazarus*, are frequently attached by the right valve, under which circumstance the teeth proper to the left and usually attached valve are transferred to the right, and *vice versâ*."—Gray, *Phil. Trans.* 1833, 776.

"In bivalve shells the apex of each valve is always placed on or near the dorsal or upper margin, varying its position on this part in the different groups. Thus in the *Pectines* and other suborbicular shells, which having a very large subcentral posterior adductor muscle, were called by Lamarck *Monomyaires*, the apex is generally in or near the centre; while in most of the other genera it is placed more or less towards the anterior extremity of this margin, and is sometimes incurved.

"In some of these shells the apex is spirally twisted, and the spire becomes more developed as they increase in size.

"Now this could not take place if the valves remained inseparably united together at the same part of the dorsal margin, but it is provided for by the hinge of the shell being gradually moved backwards on the edge of the valves, the ligaments separating in front of the hinge into two parts, one of which diverges along each of the umbones and forms a spiral groove down the suture of the whorls. In *Isocardia* the umbones seldom make more than half a turn, but in one specimen of *Chama* in my collection they have made an entire revolution, and in another a revolution and a half. The valves of these shells being unequal, the spiral part of the lower or attached valve is produced into an elongated cone, while in the other it is depressed and simply marked with a spiral groove like that of an operculum."—*Phil. Trans.* 1833, 775.

It thus appears that the valve of a bivalve shell resembles the univalve shell of a *Gasteropodous* mollusk—

1. In shape, one valve being like a dextral, and the other like a sinistral univalve.

2. That, like the univalves, these valves are sometimes reversed.

3. That the valves move on the body of the animal as the univalve shells do, to allow the deposition of new shelly matter to the margin; the position of the hinge on the margin being gradually altered to allow of this motion.

The operculum agrees with the second valve of a bivalve in all the preceding particulars.

1. The position of the nucleus of the annular operculum, or the spire of the spiral operculum, is always twisted in an opposite direction from that of the shell to which it belongs, as is the case with the two valves of a Conchiferous mollusk. This is easily observed by comparing the position of the nucleus of the dextral and sinistral genera of *Ampullariadae*, or the spiral operculum of a sinistral malformation of a Gasteropodous mollusk with that of one of the normal form.

2. These valves are sometimes reversed, as in the instances above cited.

3. The operculum moves on the foot as the valves do on the body, and they always bear the same relative situation to the valves as the valves do to each other. In the 'Synopsis' of the British Museum for 1842, p. 56, when referring to the Phytophagous Gasteropods, I observed, "Many of them have a spiral operculum or lid which is attached to the back of the hinder part of the foot of the animal. This operculum turns round backwards on the apex of its spire as it increases in size by the addition of new matter to the edge of its last whorl, so that this edge is always in the same position in the mouth of the shell."

The two valves of the bivalve move at the same rate, and therefore the lower attached valve of the *Chama*, which often has the apex produced into a conical tip like the spire of a univalve, and marked like it with a spiral groove formed by the remains of the cartilage, similar to the suture of the whorls; and the flat valve with its simple spiral groove has the same number of twists in the flat and the elevated spire of the two valves. The same appears to be the case with the opercula of univalves, as the number of volutions of the operculum appears to bear a relation to the number of whorls in the shelly valve. Thus all the shells which have many gradually increasing whorls, as the *Trochi*, *Turritellæ* and *Cerithia*, have also an operculum with many whorls which very gradually increase in size; while the *Littorinæ*, *Neritæ*, and *Naticæ*, which have a few more or less rapidly increasing whorls, have an operculum of that character which have hence been called neritoids; but there appear to be some exceptions to this rule, which require examination.

In addition to these similarities it may be observed, that the operculum, like the two valves of a bivalve, is united to the valve

of the univalve shell by muscles passing from one to the other, which by their contractions bring them together. The forms of the muscles which are used for this purpose differ in disposition and number according to the form of the mouth of the shell or the form of the valves. Thus when the valves are nearly circular, or the mouth of the univalve shell and the operculum moderate, the muscles form only a single group; on the contrary, when the valves are oblong elongate, or the mouth of the univalve shell very large, they form two groups of muscular fibres, one on each side of the valve or cavity of the shell and operculum.

This attachment of the operculum is important; for some conchologists appear to have regarded the opercula of *Gasteropodous Mollusca* as analogous to the accessorial valves of certain bivalves, such as the genus *Pholas*, which they have remarked are formed in the same manner as the true valves, by the addition of new shelly matter to the edge. But these accessorial valves are never affixed to the animal by muscle, while the operculum, as above described, is attached to the animal, and is affixed to the other valve just in the same manner as the two primary valves of a bivalve are affixed to each other.

Other conchologists, because the plug which passes through the sinus of an *Anomia* has been called an operculum or stopper, have regarded the operculum of *Gasteropods* as analogous to that substance, overlooking the fact that the plug of the *Anomia* is but a modification of the *byssus*, an excretion by which many molluscous animals more or less permanently attach themselves to other bodies, and has no affinity to a shelly valve; unless we adopt Professor Lovèn's theory above quoted, and believe the operculum to be a modification of the *byssus*. On the other hand, it may be observed, that the two valves of a *Conchiferous* mollusk are always united together by a ligament, while the opercula of the *Gasteropodous Mollusca* are always quite free from the shelly valves; but the importance of this peculiarity disappears when we consider that the two valves of the *Brachio-podous Mollusca*, which are so perfectly homologous to the valves of the *Conchifera* in other particulars, are always free and without any ligament; and secondly, that the opercula of one family of *Gasteropods*, viz. the *Neritidæ*, are furnished with a peculiar tooth-like process which enables them to move on the sharp inner lip of the larger valve, and greatly resembles the hinge of the valves on the *Conchifera*. Adanson, describing this kind of operculum, observes, "Il imite parfaitement en cela le second battant des coquillages bivalves."—*Voy. Senegal*, 41.

From these observations I was induced to believe the operculum of a *Gasteropodous* mollusk to be analogous to the shelly valve of the same animal, and that the shelly valve and the oper-

culum together are homologous to the two valves of a Conchiferous mollusk.

I was also led to believe that the normal or typical form of Mollusca is to be protected by two valves or shells, and I was strengthened in this impression by the discovery that several mollusks which have no shell in their adult state, as the *Doridæ*, &c., have their newly hatched young covered with two shelly valves which afterwards fall off.

With this idea, in the 'Synopsis' of the British Museum for 1842, p. 50, I observed, "By far the greater number of these animals (Mollusca) are provided with two of these shells or valves, which are often nearly alike in size and form, and are hence called *bivalves*, as the shells of the Conchifera, where one of the valves is placed on each side of the body and they are united together by a ligament. In others, as those of the Brachiopods, the two valves are separate, one on the upper surface or back, and the other on the under surface of the body. In others, as in the shells of Gasteropods, the two valves are so unequal that the smaller merely acts as a lid to close the mouth of the larger one when the animal is retracted into it; hence it has been called an *operculum*. This smaller valve or operculum is generally cartilaginous, either wholly formed of animal matter, or strengthened by a quantity of calcareous matter deposited on one or both of its surfaces; sometimes this valve is altogether wanting, especially in those genera which have an expanded mouth compared with the size of the remaining shell. In the bivalve Conchifera and Brachiopoda the two valves are usually nearly equal-sized, and regular in position. On the contrary, in the Gasteropods the valves are unequal, and placed more or less obliquely with regard to the axis of the elongated body of the animal."

If this theory is correct, the operculum should afford an important character for the distinction of families and genera; and this has proved to be the fact.

In 1821 I first drew attention to the very good character which it afforded, not only for the distinction of genera, but also for the division of the genera into larger groups. In my papers published in the Zoological Journal and in the Philosophical Transactions, I collected together the results of my observations on their structure, formation and growth, and their importance to the œconomy of the animal. More recent examinations have only strengthened my conviction, that they afford quite as important characters for the division of families and genera as the shell of the Gasteropods themselves, and that to neglect them in the description of the genus or species is quite as rational as to describe only the single valve of a bivalve shell. If this is the case, no specimen of an operculated univalve, which is not accom-

panied by its operculum, can be considered as complete, and every figure of the species wanting this important part must be equally imperfect; therefore it is much to be regretted that in several expensive modern works on Conchology, their artists and authors have neglected to figure the operculum of the species they have drawn; and especially as many of the specimens figured in Mr. Reeve's work, for example, have been taken from specimens in the Museum, or Mr. Cuning's collection, which had their operculum affixed on the shells, the absence of the operculum renders the excellent and characteristic figures contained in that work much less valuable than they otherwise would have been. I may add, the opercula were formerly supposed to be confined to the Gasteropodous Mollusca. They are well developed in the heteropodous genera *Atlanta* and *Oxygyrus*, the one being annular and the other spiral; and in the genus *Limacina* (or *Spirialis*) among the Pteropodous Mollusca. Some have supposed that the fossil Cephalopodous family *Ammonites* are provided with one, as an operculum-like body is often found in the cavity of these shells.

XLIV.—On *Cannabis indica*, *Indian Hemp*. By ALEXANDER CHRISTISON, F.B.S.E, Member of the Royal Medical Society*.

THE object of the present communication is to give some account of the Indian Hemp, a substance which has been long used in the Indian and Persian empires as a medicinal and intoxicating agent, but which was unknown to Europeans, except through the reports of travellers, until of late years. It was first brought into prominent notice by Dr. O'Shaughnessy of Calcutta in the year 1839.

It would be beyond the scope of this paper to enter minutely into the early history of the plant, but it may be observed that the narcotic properties of *Cannabis indica* were unknown to the Greek physicians. In the year 600 the Hindoos were in the habit of employing it, since which time it has been in constant use as a means of allaying pain, and more particularly as an intoxicating drug, among the inhabitants of the East. Hemp would seem to have been known at a still earlier period to the Chinese; in a communication to the Académie des Sciences in the early part of this year by M. Stanislas Julien, extracts are given from a Chinese work, showing that so far back as A.D. 220, a Chinese physician named Howshoa produced insensibility in his patients by means of a preparation of hemp, and that operations were then performed without pain to the patients. The veracity of this statement may however safely be questioned.

Until the year 1839 the properties of Hemp were never investigated in this country, but the essay of Dr. O'Shaughnessy published at that time attracted attention to the subject, and many experiments with

* Read before the Botanical Society of Edinburgh, April 11, 1850.

the drug have now been made. The expectations held out by him have not been so fully realized as one would be led to expect. This can however be so far explained by a want of confidence or neglect on the part of some who have employed the drug, and the use of spurious or ill-prepared substances on the part of others. From the marked success of various experimenters, it is obvious that the plant does possess useful properties as a medicine: these will be pointed out in a future part of the paper.

In Dr. Lindley's '*Flora Medica*,' *Cannabis sativa* is placed in the natural order *Urticaceæ*, no allusion being made to the *Cannabis indica*, as he obviously considers the two to be identical. It is thus described:—Flowers diœcious, male flowers racemose; calyx 5-parted, imbricated. Stamens 5. Anthers large and pendulous. Female flowers in spikes. Bract acuminate, rolled round the ovary in room of a calyx. Ovary roundish, with one pendulous ovule and two long filiform glandular stigmas. Achænium ovate, one-seeded, embryo doubled up, with the radicle parallel with the plano-convex cotyledons, and separated from them by a small quantity of albumen.

He also states that it is an annual, 3 feet high, covered all over with an extremely fine rough pubescence hardly visible to the naked eye. The stem erect, branched, bright green, angular. The leaves alternate or opposite on long weak petioles, digitate, scabrous, with linear lanceolate sharply serrated leaves, tapering into a long smooth entire point; stipules subulate. Clusters of flowers axillary, with subulate bracts; the males lax and drooping, branched and leafless at the base, the females erect, simple, and leafy at the base. Male calyx downy; female calyx covered with short brownish glands.

Dr. Lindley now places this plant in the order *Cannabaceæ*, separating it from the *Urticaceæ*, the latter having small flat stipules, limpid juice, a solid erect ovule, and a straight albuminous embryo; the former having a solitary suspended ovule and a hooked exalbuminous embryo. In the above description Dr. Royle agrees, who has seen the plant in India.

Two species of *Cannabis* have been described by botanists, viz. *C. sativa* and *C. indica*: but repeated careful comparisons have failed to discover any material difference between them; the generally received opinion now being, that the same plant under the modifying influence of climate and cultivation puts on a variety of characters. This opinion has been fully borne out by the result of an experiment in the Botanic Garden, which it may be interesting to detail.

A few seeds picked from fresh Gunjah were sown on the 17th of March 1849, as well as some seeds from decayed Gunjah: the latter never germinated, but the others appeared above ground in a few days; in the course of a week they attained a height of 3 inches under glass. Three shoots were planted in the open air, while the remainder were kept in the hothouse. On August 1st those without had attained a height of $4\frac{1}{2}$ feet, and it was remarked that they had a peculiar strong *minty* odour. On the 1st October one of these was $9\frac{1}{2}$ feet high, with several strong woody stems and abundant foliage: flowering appeared to be commencing, but owing to advance of the season

the leaves were withering. The plants in the hothouse at the same period were 4 feet high, slender, with few leaves, but in full flower. Plants of the common hemp growing in the Garden had a very similar aspect, being however in full fruit.

I am indebted to the kindness of Professor Balfour for the following remarks and botanical description of these plants:—"Those in the open air were all female plants; among those in the hothouse were one or two males. I have not been able to make out any specific difference between the so-called *C. indica* and *C. sativa* of Europe. The common hemp in the Garden has not attained the same size as the plants from Indian seeds, and the segments of the leaves are narrower; in other respects they appear alike, more especially as regards their flowers, glands, &c. Both the Indian and European seeds produce plants which have a strong resinous odour. In this respect the European plants in the garden seem to excel the Indian. On the Indian specimens even when cultivated in the hothouse there has not appeared any of the Churrus described by Indian observers. The racemes and spikes of flowers have a resinous feeling when touched. The following is a description of the plants raised from the Indian seeds:—

"*Flowers* dioecious. *Male* plants in the hothouse about 4 feet high; circumference of stem at the base about one inch, lower part of the stem woody. *Stem* somewhat quadrangular, grooved and roughish; surface of the stem at the base of a brownish colour, mixed with greenish streaks. *Leaves* opposite, sap-green above, pistachio-green below, quinate to septenate, at the upper part of the stem the leaves become alternate; segments of the leaves feather-veined, with a prominent midrib below, lanceolate, acute, with large serratures. *Stipules* 2, subulate.

"*Flowers* in cymose axillary leafy clusters, some of them abortive. *Perianth* of five ovate blunt segments, which are of a pale green colour (the margins being white and the centre greenish) with a marked green midrib, covered externally and internally with glandular pubescence; segments of the perianth concave internally. *Stamens* covered with glandular pubescence, opposite the segments of the perianth. *Anthers* large, projecting beyond the perianth, oblong, bilocular, erect, with an apicular process and longitudinal dehiscence, supported on slender filaments which are shorter than the anthers and have pyramidal bases; pollen spherical, with three facets, each consisting of a small ring in the centre of a larger one. In the centre of the flower there is the rudiment of the pistil.

"*Female Plants*. These are much stronger than the male plants, have attained a greater size, and have a stronger balsamic odour; those in the hothouse attained a height of 5 feet, and those in the open air 9½ feet; stems hollow, 4 inches in circumference, with a tenacious stringy bark. Leaves covered with minute vesicular sessile glands, which give out a viscid resinous-like exudation, and are interspersed with glandular hairs. Flowers in aggregated spikes; usually three or more unibracteate flowers in a cluster in the axil of floral leaves which are often tripartite.

“*Perianth* monophyllous, convoluted, swelling at the base where it includes the ovary. Floral leaves, bracts and perianth covered with glandular pubescence.

“*Pistil* one. Ovary one, rounded, containing a single orthotropical erect ovule. Style short, terminal, ending in two elongate filiform pubescent stigmata. *Fruit* a caryopsis. Seed erect, marked with a coloured hilum. Embryo exalbuminous.”

One or two remarks are suggested by this experiment:—1st. That the minute glands under favourable circumstances might act vigorously in producing the active resin. 2nd. That a certain climate which we cannot imitate is necessary to cause this action. 3rd. That the *C. indica* and *C. sativa* are identical; and 4th. That the Hemp plant possesses a peculiar odour of considerable strength, which is not alluded to in the standard works on Botany and Materia Medica.

It may here be observed, that the *Humulus Lupulus* or Hop, which owes its properties like *Cannabis* to a glandular resinous secretion, belongs to the same natural family and is endowed also with narcotic properties.

A short account will now be given of some of the principal forms in which Hemp is met with in the markets of the East; these are:—1. *Haschich*. 2. *Bhang*. 3. *Gunjah*. 4. *Churrus*. 5. A variety of electuaries, pastes, &c., in all of which butter or some other oleaginous matter is the basis of formation.

I. The first or *Haschich* is the Arabian name given to the dried tops of the plant grown in Upper Egypt, the meaning of the word being “herb,” or “*herbe par excellence*,” the tops are gathered some time before the seeds are come to maturity.

II. *Bhang* is an Indian preparation consisting of the larger leaves and capsules, which according to Dr. O’Shaughnessy is the cheapest form used in India, and therefore in common use among the lower orders for smoking, &c.; from it is prepared an intoxicating drink, and it forms a part of the confection called Majoon.

III. *Gunjah* is the chief Indian form of the dried plant, and consists of the drier tops of *Cannabis* after flowering, and from which the resin of the leaves has not been removed; it is chiefly sold in the Calcutta bazaars for smoking, in bundles 2 feet long and 3 inches in diameter; the colour is dusky green, the odour agreeably narcotic, the whole resinous and adhesive to the touch. The specimens I have examined consist of a central stem with branches, round which are aggregated elongated oval masses about $1\frac{1}{2}$ inch long, and closely pressed together by adhesive resinous matter; when steeped in water these masses can be teased out, and are found to consist of the tops of the plant, that is, the flowers, fruit, and smaller leaflets.

IV. *Churrus* is the resinous secretion alone, and is therefore the most powerful shape in which hemp may be used; but it is at the same time expensive, and is not met with in Europe except as a museum specimen. The specimens in Dr. Christison’s museum are variously-sized, nodulate, round masses from the size of a pea to that of a walnut, and of greenish black colour. It is collected during the hot season by scraping the leaves and tops. Dr. O’Shaughnessy states,

that in Central India and Nepal men in leathern dresses brush forcibly through the plants, and the resin which adheres to them is then scraped off. And Dr. McKinnon states that in Nepal the resin is gathered on the backs of naked coolies. Dr. Royle says, "The glandular secretion is collected from the plants on the hills, by the natives pressing the upper part of the young plants between the palms of their hands and scraping off the secretion which adheres."

V. In the preparation of the electuaries, &c., butter is used as the means of separating the active principle, consequently these compounds are very apt to become rancid. They are thus described by M. Charnac in the 'Annuaire de Thérap.' for 1846 :—

1. Preparations mixed with honey or melted sugar. 2. A more active form called *hachich kava-mesk* (musked drug), containing musk, essence of roses and almonds, of pasty consistence, and of the colour of impure honey; the quantity used being about the size of a walnut. 3. Two kinds are found at Smyrna, called Israël, the one a fine powder, the other a roll of firm mastic consistence. 4. A black round kind has great aphrodisiac repute among the Fellahs, but in this case it is found that cantharides is added to increase the effect.

At Cairo the compound from which the various conserves are prepared is thus made. Equal parts of well sifted haschich, butter and water are put in a vessel on the fire; after some boiling the water is dissipated; the residue is twisted in a cloth to isolate the fatty matter, and to this the different spices are added.

Haschich is to the Arabians what opium is to the Turks and Chinese. Hachach, signifying in Arabian drunkard, is the epithet applied to those who eat haschich.

The Arabians smoke the powdered plant, free of seeds, which contain fatty, disagreeable-tasted matter, along with tobacco.

VI. Landerer describes a tincture of hemp used at Cairo, called Chatsraky, made by infusing in spirit for three weeks with a gentle heat, the varnish-covered bark sliced from the stems when the plants are in flower.

As the activity of the preparations of hemp depends on the presence of a resinous varnish on the leaves, and consequently as the most active of these is found to contain the largest quantity of resin, it becomes a matter of great importance to decide upon the proper period for collecting the plant.

M. Gastinell, an apothecary at Cairo in 1849, states that he found the active powers of hemp to depend on a resinous matter which forms on the leaves as the seeds ripen. Again, M. de Charnac observes, that in Egypt the tops of the plants are used at the end of flowering, but before complete maturity of the seeds. And Mr. Jameson, Director of the Botanic Gardens at Saharunpore, makes a like statement in a letter dated 17th August, 1849. As this letter contains an interesting account of Hemp in that part of India, it has appeared to me to be well worthy of a place in this essay. He says—"In Kimaon and Gurhwal *Cannabis* is grown in large quantities, partly in order to obtain its resinous secretion, and partly for its bark, from which a strong coarse cloth called *Bungila* is manufactured; it forms

the dress of the poorer inhabitants, particularly through Gurhwal. It is sown in July and gathered in October. From the female plants only the Churrus is procured. Towards the beginning or middle of October the seeds begin to form, and when in this unripe state the upper part of the plant is pressed between the palms of the hands, it deposits upon them a yellowish green secretion, which is scraped off with a blunt knife: this is the well-known Churrus. From the male plant Bhang and Cath are prepared. Bhang is prepared by drying the leaves and other parts of the plants, both male and female, and is thus used:—A small quantity is put into a mortar with a little water and pounded; the refuse water being thrown away, an additional quantity of water is then added, from half a pint to a pint, depending on the strength required, and well mixed; it is then strained through a fine cloth, the residue thrown away, and the liquid is ready for drinking, a wineglassful or more being taken at a time. Gangah is the thin preparation, and is the produce of the upper portion of the stem, that is about $1\frac{1}{2}$ foot; it is only used in the hookah to smoke; this also applies to the Churrus. The Gangah is carefully dried and mixed with an equal quantity of tobacco, and well rubbed together in the palm of the hand; it is then ready for the hookah. We have thus the three preparations:—1. Churrus. 2. Bhang or Lubzi. 3. Gangah or Ghangah. The first is only prepared on the hills, and the two latter are common to both hill and plain, but Bhang is principally prepared in the latter. At Bhaeit, about sixteen miles from Saharunpore, it is prepared in large quantity, and is subject to a heavy duty; yearly from 40,000 to 50,000 maunds are produced (a maund is equal to 80 lbs.). The reason why the Churrus is not prepared in the plains is, because the plant does not secrete the resinoid principle, showing that its secretion is connected with climate. But still the plants are identical in external characters, and you will I think find that the European and Indian plants are also identical. In order to ascertain the fact, I send you a small packet of hemp-seeds procured at one of the Gurhwal villages where it is grown in vast quantity. In your letter you say that the active principle forms on the stems and leaves; this is not the case, as it is only procured when the seeds are in an unripe state;—attempt to procure it before this period, and none will be forthcoming. It will appear strange how ignorant natives can distinguish female from male plants—were you to see the plant growing your surprise would soon be removed. The female plant when ready for making churrus has at its upper part a “bunchy” appearance, whereas the male plants have become by this time mere stems and leaves, the flowers also having fallen off.

“In October, in crossing the Himalayas from Almorah to Missouri, I have passed through dozens of villages 6000 to 8000 feet above the level of the sea, and seen hundreds of men, women and children, all employed in making churrus. The plant grows to a height of from 10 to 14 feet.”

The plants cultivated in the Edinburgh Botanic Garden present exactly the characteristic difference between male and female described by Mr. Jameson.

From these observations then it appears to be undoubted, that the only period for collecting the plant in its active state is that time when the seeds are beginning to ripen, when therefore the tops of the plants are covered with the resinous varnish on which its properties depend.

The resin secreted by *Cannabis* is insoluble in water, but soluble in rectified spirit; and it may also be separated by oily matters. By the action of spirit upon Gunjah the extract of hemp is formed. In this country two extracts are used, the one sent from Calcutta, and the other prepared in England from the dried plant. The best extract presents a dark green colour and is thick and tenacious; when pressed between the fingers it softens and adheres obstinately to them, a solvent being necessary for its removal;—any extract which is found to rub down in the fingers should be looked upon with suspicion, and will be found to be nearly if not almost totally inert. The finest extract I have seen is that prepared by Mr. Robertson, Professor of Chemistry at Calcutta, which however is not in the market. Of this Mr. Robertson prepared about 30 lbs.; from a hundredweight of the plant he obtained about 8 lbs. of extract. His process consisted in passing the vapour of boiling alcohol through the plant packed in a cask, an ordinary worm leading from the cask to a receiver; the preparing of it cost him much time and trouble on account of the heavy duties upon hemp and also upon spirit, and the expense he reckoned at 15s. a pound. On these accounts he abandoned the attempt to manufacture it in this way, and though he received large orders for it from various quarters, he felt compelled to refuse the undertaking. Specimens were sent for experiment to various parts of Europe, and among others to Edinburgh for Dr. Christison; this is now four years old and retains all its energy, and is much more active than the extracts of the shops which are formed by cold percolation. I repeated his process on a small scale and found it to be a very complete means of exhausting the plant, while at the same time the consumption of spirit is less.

Good extract should give a grass-green tincture with spirit, and when the tincture is of a brown colour it is weak or inert.

Various investigations have been made as to the nature of the resin secreted by the leaves of *Cannabis*, and it has been ascertained that a pure resin can be separated retaining the properties of the plant in full energy. Gastinell, apothecary at Cairo, has prepared this substance, of which he says 2 grs. are as effective as 6 of alc. extract. M. de Courtive of Paris says that the resin prepared by him is in the dose of $\frac{3}{4}$ gr. as effective as 30 grs. alcoholic extract. He also prepared the resin from Paris-grown hemp and from French hemp, 6 grs. of the first, and 8 to 16 of the second being necessary to produce the effect. Surely he cannot have obtained a pure resin, when such various doses are required; for the pure principle, from whatever source obtained, should possess exactly the same activity in every case.

The Messrs. Smith of Edinburgh have made careful experiments on this subject: they observe that the narcotic action of hemp resides

in a soft neutral resin called Cannabine, which when heated gives out a strong aromatic smell, and has a warm pungent balsamic taste ; that it is insoluble in water or weak spirit, which is clearly proved in the following way—the addition of a fifth of water to a solution of the resin in strong spirit causes separation to begin, and all the resin is thrown down when a half of water is added. For a detail of their process I must refer however to the ‘Pharmaceutical Journal’ for 1846, merely observing at present, that in repeating the process with old Gunjah of 1840, ten per cent. of resin was obtained, answering to the characters given above ; that the whole occupied a period of three weeks, and was very tedious. The following is a rough estimate of the composition of 8 oz. of Gunjah, used in my process :—

Resin	390 grs.
Nearly dry watery extract	500
Extractive by carb. soda	640
Vegetable fibre, &c.	2310
	<hr/> 3840

The physiological actions of *Cannabis indica* must now be considered, and the first question which presents itself is, whether this plant is a poison in large doses, and has it proved fatal to man ? The prolonged use of it has certainly destroyed many in India, but no mention is made by authors of its proving fatal in one or two large doses. The only allusion to such an effect that I have seen, is that made by Mr. Reddie, a member of the Calcutta Bar, who in a letter to Dr. Christison, dated July 1849, says :—“The plant is a poison with many of the qualities of opium and some singular ones peculiar to itself,” and that “it is frequently used at Calcutta as a poison.” As this information was unsolicited, no details have been given, but Mr. Reddie has offered to give any additional information that may be required. Dr. O’Shaughnessy made a series of experiments on animals with the view of determining the quantity that it would be safe to administer as a medicine, but in none of these did death occur. In one experiment he gave 10 grs. churrus to a middling-sized dog. “In half an hour he became stupid and sleepy, dozing at intervals, starting up and wagging his tail as if extremely contented ; he ate some food greedily ; on being called to, he staggered to and fro, and his face assumed a look of utter and hopeless drunkenness. These symptoms lasted about two hours ; in six hours he was perfectly well and lively. And again 20 grs. of ext. Gunjah, dissolved in spirit, were given to a dog of very small size. In a quarter of an hour he was intoxicated ; in half an hour he had great difficulty of movement ; in an hour he had lost all power over the hinder extremities, which were rather stiff, but flexible ; sensibility did not seem to be impaired, and the circulation was natural. He readily acknowledged calls by an attempt to rise up. In four hours he was quite well. In none of these experiments was any pain evinced, or any convulsive motion.” The dose mentioned above was the largest he gave ; and the question remains, would yet larger doses have had a fatal effect ? One point is however determined,—and Dr. O’Shaughnessy administered large

and repeated doses with benefit in treating disease,—that so large a dose as 10 grains of churrus did not prove fatal to a dog.

A very curious result of Dr. O'Shaughnessy's experiments is, that carnivorous animals and fish very speedily underwent the effects of hemp, while graminivorous animals were only very slightly affected even by large doses of the drug.

The physiological action of hemp is in the first place stimulant in small doses, exciting the cerebral and digestive systems; and secondly, when given in larger quantity its effects are powerfully sedative and antispasmodic; and at last it induces insensibility. A consequence of these properties is the extensive use of the compounds of hemp in the East for the purpose of causing intoxication, and the effects correspond to the natural disposition of the individual. In some mere laziness and stupidity are induced, in others a pleasing state of reverie without other remarkable condition; and many are attacked with loud laughter, fits of dancing and singing, venereal appetite, inclination to quarrel, according to the various dispositions. The aphrodisiac action is by most authors regarded as peculiar to the hemp, but on the other hand there are some who regard this effect as merely depending on the disposition of the individual.

But what really appears to be inherent in the plant is, that in all there is a remarkable desire for food; it is quite astonishing and at the same time very ridiculous to observe an individual under the influence of *Cannabis* eagerly devouring his food without stopping, and apparently without any intention of so doing.

It has been noticed by Dr. O'Shaughnessy and others in India, that in most cases the effect of hemp is powerfully aphrodisiac. After the stage of excitement, sleep supervenes; and on waking the experimenter returns to his natural state, except that the ideas are often confused for a little, and in some cases vertigo is present to a slight extent. An example of the great extent to which the use of hemp is pushed in India is given by M. Liautaud, in his communication to the Académie des Sciences, as follows:—

“The grand feast of Dourga Pondja is terminated by the ceremony of immersing the idol in the river; after which the people return to intoxicate themselves with a drink from the leaves of hemp, and the whole ends in a scene of disgraceful drunkenness;” and in allusion to the physiological action, M. Liautaud remarks, that “there is peculiar ecstacy without convulsion;” that “the drinks excite the nervous system more than the powder or smoke.” “This intoxication has appeared to him much less intense than that of opium and that produced in the Chinese smoker; the consequences are not so deadly, but the moral degradation the same.”

Dr. O'Shaughnessy thus described the delirium induced by the incautious use of hemp:—“The state is at once recognized by the strange balancing gait of the patient, a constant rubbing of the hands, perpetual giggling, and a propensity to caress and chafe the feet of all bystanders of whatever rank. The eye wears an expression of cunning and merriment which can scarcely be mistaken, there is no increased heat or frequency of circulation, and the skin and general functions are in a natural state.”

An interminable variety of ideas enters the mind when under the influence of hemp. In the work of Moreau, 'Du Haschich,' some interesting details of these effects are given. Among others, M. Théophile Gautier, in describing his sensations, says:—"After a feeling of numbness, it appeared to him that his body became transparent, and that he saw within his breast the haschich which he had eaten, in the form of an emerald, from which issued millions of little sparks. At the same time his eyelashes became indefinitely elongated, and began to roll as gold threads upon small ivory wheels which revolved with great velocity." A very curious effect was an increase of his power of hearing, whereby slight noises became as loud as thunder, and he heard the noise of colours, green, red, blue and yellow sounds coming to him in perfectly distinct waves; he did not dare to use his voice in case he should knock down the walls or burst himself like a bomb. His calculation of the time he enjoyed these dreams was about 300 years; the fact being that only a quarter of an hour had elapsed.

Dr. Christison describes the effects upon himself as follows:—On trying Mr. Robertson's extract once for toothache, I found that about 4 grs. taken about 3 A.M. caused in an hour cessation of pain, a pleasant numbness in the limbs, giddiness, a rapid succession of unassociated ideas and impossibility to follow a train of thought, frequent intervals of sleep, and slight increase in the force of the pulse; at the same time he felt no pain, while he was quite conscious the toothache was present. Next morning there was an ordinary appetite, much torpidity, great defect and shortness of memory, extreme apparent protraction of time, but no peculiarity of articulation or other effect, and these symptoms lasted till 2 P.M., when they ceased entirely in a few minutes after taking lemonade.

One or two cases have come under my own observation; the first of these illustrates the less powerful and more gradual effect, when the hemp extract is taken in the form of pill. On the 3rd of April at 4 P.M., a friend took 2 grs. of the extract prepared by Mr. Robertson. At a quarter past six he felt as if weak, chiefly about the knees, with slight inclination to laugh; stupidity and forgetfulness, but without reverie; he continued in this state till he retired to bed, where he slept soundly. Next day he was perhaps more stupid than before, but was enlivened by drinking lemonade; he was not exactly himself till the following day; his appetite was strong, but he was not affected in any other way.

In the second experiment I took on the same day 1 gr. of the same extract dissolved in spirit, and though only half the quantity used in the first case, the effects were much more apparent. At a quarter past five, when sitting down to dinner, I felt a peculiar numbness creeping through my body and limbs; I did not think this was the action of the *Cannabis*, and began to fancy I was very ill, so that I could not eat my dinner; I lay down, and the numbness continued for a quarter of an hour, when my sensations became agreeable. I laughed heartily several times, answered questions incoherently, and immediately forgot what they were about; delightful reveries came over me, and whatever I looked at became lost as it were in a maze; the lamp appeared to

be slowly turning round, and when I lost sight of this, the red lines on the paper of the room appeared to intertwine in a most beautiful manner. The most remarkable effect was the constant succession of new ideas, each of which was almost instantly forgotten; when roused to tea I ate ravenously without feeling satisfied; I slept soundly, and next day was stupid and forgetful, but was much improved by drinking lemon-juice. On the following day I was quite recovered.

My friend Mr. MacLagan has kindly described for me his sensations under *Cannabis* on the same day as above; he says:—"I took 2 grs. dissolved in spirit and 1 gr. as pill shortly afterwards; this was at 4 o'clock. At a quarter to six when seated at dinner, and after taking a copious draught of water, I felt a curious buzzing in my ears, with slight tinnitus aurium and giddiness; two minutes after, burst into an immoderate fit of laughter without any cause; I was asked what I meant, but disdained to answer, and despite of rebuke I laughed on for about five minutes. I then retired, but after walking from room to room for some time, I found myself quite unable to appear with my family, and therefore went to Dr. Christison's house, experiencing however great impediment by my legs bending under me at various angles. At one time, thinking a man was in pursuit, I took to my heels, and did not stop till I reached Dr. Christison's door; when it was opened I laughed in the servant's face and walked upstairs, where I continued to laugh till Dr. Christison entered the room, when my laughter became aggravated, and his questions were only answered by monosyllables and grins; I lay down on a sofa, where delightful sensations continually occurred to me.

"At 8 o'clock I got tea and ate three slices of bread; voracity seemed to be my object; I again lay down and laughed and sang till 10 o'clock; many of my exclamations, I was told, were decidedly verging on the affectionate. I also raised my right leg at regular intervals, and then let it fall upon the other, for a long time."

Such are the observations which have been made on the physiological action of Indian Hemp. I might have entered upon its therapeutic effects in hydrophobia, tetanus and other diseases, but this subject being connected more immediately with medical practice, is not fitted for the Botanical Society.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

June 19, 1849.—The Lord Bishop of Norwich, President, in the Chair.

Read "Descriptions of seventeen new species of the Coleopterous family *Paussidæ*." By J. O. Westwood, Esq., F.L.S. &c.

Genus CERAPTERUS, Swed.

Subgenus ORTHOPTERUS.

Cerapterus (Orthopterus) La Fertei, Westw.

C. piceo-castaneus nitidus lævis, pronoto magis fulvescenti-castaneo, elytris nigro-castaneis tenuissime punctatis: singulo plaga longitudinali

per dimidium posticum suturæ extensa ad apicem recurva et cum margine externo parallela fulva; pronoto linea impressa media; disco haud setoso, pedibus rufo-castaneis.—Long. corp. lin. 6.

Hab. in Africa occidentali tropica apud "Rio Grande," inter Gambiam et Sierram Leonam.

In Mus. D. La Fertei.

Obs. The club of the antennæ is $2\frac{1}{3}$ rd longer than broad; the terminal joint is equal in length to the ninth, eighth, seventh, and $\frac{1}{3}$ rd of the sixth joints.

Cerapterus (Orthopterus) concolor, Westw.

C. totus obscure castaneus nitidissimus, elytris magis nigricantibus; pronoto linea media longitudinali vix distincta; elytris basi et lateribus punctis setiferis instructis; disco magis evidenter punctato, tibiis rufo-castaneis.—Long. corp. lin. 6.

Hab. apud Portum Natalensem Africæ meridionalis.

In Muss. Brit. et Fortnum.

Obs. The club of the antennæ is $2\frac{1}{3}$ rd times longer than broad; the seven intermediate joints are of equal breadth, the last joint is rather convex, and as long as the ninth, eighth, seventh, and half of the sixth united.

It is impossible, without a comparison with Mr. W. S. MacLeay's original specimen of *C. Smithii*, to determine whether this species may not prove a concolorous variety of that insect. Judging from the description and figure of the antennæ however, this supposition appears very doubtful.

Subgenus ARTHROPTERUS.

Cerapterus (Arthropterus) denudatus, Westw.

C. picco-castaneus subnitidus tenuissime punctatus, elytris magis nitidis, antennis angustis planis; articulo ultimo duobus præcedentibus longitudine æquali, capitis angulis posticis porrectis, prothorace capite paullo angustiori supra subdepresso truncato-cordato linea media impressa, pedibus subangustis; tibiis omnibus angulo externo apicali acuto.—Long. corp. lin. 6.

Hab. in Nova Hollandia, ad ripas fluvii "Mundarra" dicti.

In Mus. F. Bond.

Cerapterus (Arthropterus) Wilsoni, Westw.

C. totus castaneus nitidus, capite parvo punctato et inter oculos bi-impresso: angulis posticis vix ultra oculos laterales porrectis, antennarum clava subangusta sub lente tenuissime granulata; articulo 3tio clavæ latiori: ultimo angustiori longitudine vix tribus præcedentibus æquali, pronoto subquadrato punctato: angulis anticis rotundatis: disco haud longitudinaliter sulcato; elytris elongatis tenuissime punctatis: punctis ad basin majoribus castaneis: sutura magis fulvescenti, pedibus angustis; tibiis vix tarsis duplo latioribus.—Long. corp. lin. 7.

Hab. in Novæ Hollandiæ Adelaide, D. Wilson. In Mus. Westw.

Cerapterus (Arthropterus) subsulcatus, Westw.

C. totus castaneus, capite punctato inter oculos haud impresso: angulis posticis pone oculos valde porrectis, antennis tenuissime punctatis clava sensim a basi ad articulum ultimum latiori; articulo ultimo sexta parte latiori quam longo tribusque articulis præcedentibus longitudine subæquali, pronoto punctato cordato-truncato: sulco longitudinali medio

fere omnino obliterato, elytris longitudinaliter subsulcatis vix punctatis : disco setis brevissimis pauciter instructo basi longius setosis, tibiis tarsis plus duplo latoribus basi angustioribus apice externo præsertim in pedibus anticis acutis.—Long. corp. lin. $5\frac{1}{2}$.

Hab. in Nova Hollandia, King George's Sound. In Mus. D. Parry.

Subgenus **PLEUROPTERUS.**

Cerapterus (Pleuropterus) alternans.

C. rufus, elytris magis fulvis : singulo plagis duabus latis nigris postice conjunctis, opacus fere lævis, capite brevi ; vertice antice longitudinaliter impresso punctisque duobus impressis intra partem oculorum posticam, antennis fere planis ; clava e basi ad apicem sensim angustata : articulo basali postice in lobum rotundatum producto, pronoto transverso : angulis anticis rotundatis : posticis valde incis : inter angulos posticos tuberculis duobus rotundatis instructo ; disco valde irregulari sulco profundo longitudinali ; elytrorum humeris elevatis : disco singuli 4-costato, pedibus longis gracilibus.—Long. corp. lin. 4.

Hab. in Mozambique et apud Portum Natalensem.

In Mus. Melly (e Mus. Berol. cum nomine supra indicato transmissus) et Mus. D. Fortnum.

Cerapterus (Pleuropterus) hastatus.

C. piceus tenuissime punctatus pubescens, elytris subopacis, capite antice sulcato, antennis magis quam in specie præcedenti regularibus et supra nonnihil concavis ; articulo basali clavæ extus in tuberculum obtusum intus sinuatum producto : articulis reliquis longitudine fere æqualibus : ultimo rotundato, pronoto breviter cordato-truncato : angulis anticis valde obtusis posticis valde incis utrinque inter angulos posticos tuberculo elevato instructo ; elytris obscure piceis basi costatis : singulo macula prope basin altera pone medium cum macula suturali connexa margineque postico fulvis, pedibus gracilibus.—Long. corp. lin. 5.

C. (P.) Westernmanni affinis, at lator, magis pubescens, antennis et prothorace aliter formatis.

Hab. in Mozambique. In Mus. D. Melly (e Mus. reg. Berol. cum nomine supra indicato transmissus).

Genus **PENTAPLATARTHUS.**

Pentaplatarthrus natalensis.

P. castaneo-nigricans, elytris interdum cruce nigra notatis, antennis planis articulis clavæ subcontinuis (nec basi et apice constructis ut in *P. Paussoide*), prothoracis lateribus in medio angulatis.—Long. corp. lin. $4\frac{1}{2}$.

Hab. apud Portum Natalensem Africæ meridionalis. In Mus. Westw. &c.

Obs. On a careful comparison I can detect no other characters to separate the somewhat larger Port Natal specimens recently arrived in this country from the typical specimen of *P. Paussoides* now in my collection. I have employed above the name given to these insects in the Royal Berlin collection, but scarcely consider them specifically distinct.

Genus **PAUSSUS.**

Sect. A. Prothorax quasi bipartitus.

Subsect. a. Antennarum clava postice haud excavata.

Paussus sinicus, Westw.

P. subcylindricus niger subopacus setis minutissimis griseis undique sparsis obsitus, elytrorum apice et angulo postico externo piceis, capite

tuberculo obtuso inter oculos serieque quatuor minorum prope collum, antennarum clava angusta in medio angustiore apice clavato et supra seriebus duabus tuberculorum parvorum (in singula serie tribus) in apicem insidentibus, prothorace bipartito: parte antica haud postica latiore: lateribus angulatis, palpis maxillaribus articulo 2ndo intus ad apicem acuminato-producto, labialibus articulo ultimo ovato-acuminato.—Long. corp. lin. 4.

Hab. prope Hong Kong. D. Bowring.

In Mus. Britann.

Obs. I have adopted the specific names proposed by Capt. Champion, for this and the two other species brought from Hong Kong by Mr. Bowring, and presented by him to the British Museum.

Paussus granulatus, Westw.

P. luteo-fulvus disco elytrorum magis rufescenti, podice piceo, capite inter oculos bi-impresso tuberculisque duobus excavatis instructo: angulis anticis supra basin antennarum productis, antennarum clava falcata apice acutissimo setaque unica apicali instructo, palpis maxillaribus articulo 2ndo fere rotundato, capite subnitido gracillime cetrinoso, pronoto glabro; elytris opacis granulatis: singulo plaga longitudinali submembranacea grisea impresso, pedibus gracilibus; tibiis 2 posticis magis dilatatis.—Long. corp. lin. $3\frac{2}{3}$.

Hab. in Africa meridionali, prope Portum Natalensem.

In Mus. D. Fortnum.

Subsect. *b.* Antennarum clava postice excavata.

* Species Indicæ.

Paussus politus, Westw.

P. fulvo-rufus, pronoti lateribus posticis discoque elytrorum nigris, capite tuberculo conico parum elevato inter oculos, antennarum clava naviculari: margine antico fere recto: apice rotundato: margine postico excavato excavatione acuminato-ovali margine supero simplici infero 5-denticulato et 5-setoso, prothorace bipartito: parte postica antica haud latiori, elytris nitidis lævibus breviter setosis lateribus longius setosis, podice rufo setarum serie marginato, pedibus subgracilibus; basi femorum obscuriori.—Long. corp. lin. $3\frac{1}{2}$.

Hab. in India orientali, D. Bacon. In Mus. Westw., &c.

Obs. Nearly allied to *P. ploiophorus* and *denticulatus*, but differs in the narrowed hind-part of the prothorax; also to *P. nauceras*, but differs in the glossy elytra and different shape of the antennæ.

Paussus Bowringii, Westw.

P. niger nitidus, clava antennarum parte pronoti antica elytrorumque basi lateribus apiceque ferrugineis, capite inter oculos tuberculo elevato quasi e tuberculis duobus minutis composito, antennarum clava lata margine antico acuto postico profunde fossulato: fossulæ margine supero recto infero 6-denticulato, pronoti partis anticæ lateribus acute angulatis: parte postica angustiori lateribus sinuatis, palporum maxillarium articulo 2ndo lato subquadrato, elytris brevissime setosis lateribus setis longioribus densius obsitis.—Long. corp. lin. $3\frac{1}{2}$.

Hab. ad Hong Kong. - D. Bowring.

In Mus. Britann.

Paussus hystrix, Westw.

P. obscure ferrugineus opacus, capite antice emarginato; vertice tuberculis duobus ovalibus elevatis, antennarum clava oblonga subovata

postice excavatione oblonga instructa : hujus marginibus supero et infero sinuatis seu tuberculis rotundatis quinque instructis, prothorace capite paullo angustiori : parte postica antica parum angustiori : lateribus fere rectis, elytris lateribus rufo setosis : singulo ante medium disci impressione ovali alteraque elongata subcurvata laterali instructis, podice serie setarum marginato, pedibus angustis, palporum maxillarium articulo 2^{do} fere rotundato.—Long. corp. lin. 3½.

Hab. ad Hong Kong. D. Bowring.

In Mus. Britann.

**** Species Africanæ.**

Paussus cucullatus.

P. totus castaneus subnitidus tenuissime punctatus, pronoto magis nitido lævi, capitis vertice impressione ovali marginibus elevatis in qua tubercula 2 parva ovalia exstant, antennarum clava glaberrima late ovali basi truncata postice profunde excavata intus prope marginem anticum necnon margines excavationis transverse impressa, prothoracis parte antica brevi lateribus acute angulatis : postica multo angustiori in medio profunde impressa, pedibus dilatatis, podice setarum serie marginato, palporum maxillarium articulo 2^{do} lato rotundato.—Long. corp. lin. 2.

Hab. in Africa meridionali apud Portum Natalensem. In Mus. D. Melly cum nomine supra indicato e Mus. Reg. Berol. communicatus.

Sect. B. Prothorax subcontinuus.

Paussus spinicoxis, Westw.

P. angustus castaneo-testaceus, capite elytrisque tenuissime punctatis, capite tuberculo conico dorsali inter oculos armato, oculis magnis, antennarum clava subovali undique acute marginata punctata basi externe in dentem producto, disco utrinque versus marginem posticum 4-impresso, prothorace glabro subcontinuo angulis anticis rotundatis : parte antica a postica fossula profunda transversa utrinque setosa separata, elytris glabris, podice marginato punctato, palpis maxillaribus subfiliformibus articulo 2^{do} parum crassiori, pedibus gracilibus ; coxis 2 posticis in spinam productis.—Long. corp. lin. 4.

Hab. in Africa meridionali apud Portum Natalensem.

In Mus. Britann.

Paussus cultratus.

P. totus testaceo-fulvus punctatus et breviter setosus, capite supra convexo integro angulis posticis pone oculos porrectis, clypeo emarginato, antennis depressis late-falcatis apice acutissimis margine omni acuto glabris tenuiter punctatis, palpis maxillaribus filiformibus, prothorace ovali antice posticeque truncato in medio parum depresso glabro excavationibus duabus profundis subrotundatis in medio notato, pedibus subgracilibus ; tibiis compressis et ante apicem sensim angustioribus, podice punctato setoso margine acuto elevato.—Long. corp. lin. 3.

Hab. in Africa meridionali apud Portum Natalensem. In Mus. D. Melly cum nomine supra indicato e Mus. Reg. Berol. communicatus.

Paussus setosus, Westw.

P. luteo-castaneus setis aureis obsitus, capite antennis pedibusque magis castaneis, capite inter oculos tuberculo elevato setigero instructo, clypeo vix emarginato, antennarum clava elongata lateribus parallelis margine omni acuto basi externe in dentem conicum apice setosum producto margine postico setarum curvatarum serie instructo, protho-

race oblongo: parte antica parum latiori lateribus rotundatis: partis posticæ lateribus fere parallelis: in medio disci impressione profunda subquadrata, elytris profundius punctatis, podice setarum serie marginato, pedibus gracilibus longioribus.—Long. corp. lin. $3\frac{3}{4}$.

Hab. in Guinea.

In Mus. D. La Fertei.

Read also a continuation of Mr. Huxley's paper "On the Anatomy of the *Diphydæ*," &c.

November 20.—William Yarrell, Esq., V.P., in the Chair.

Mr. Hogg, F.L.S., presented two spikes of a variety of *Hordeum hexastichon*, L., grown from seeds sown in March of the present year at Norton in the county of Durham. The seed was derived from some found in the pocket of a sailor, who died during a voyage in the Mediterranean. Mr. Hogg designates this variety as *H. hexastichon* var. *seminibus nigris seu cæruleo-nigris*, "black, or rather blue-black Bigg." He states that he cannot find in authors any description at all answering to it, although Persoon and Séringe mention a similar variety of the common barley, *Hordeum vulgare*, L. The variety presented by Mr. Hogg ripens early, is exceedingly prolific, and has large grains; and he therefore considers it worthy of cultivation, and though perhaps not so well adapted to malting as the common barley, yet likely to be valuable for other purposes, and particularly for the fattening of cattle.

Read a Paper "On the Development of the Spores and Elaters of *Marchantia polymorpha*." By Arthur Henfrey, Esq., F.L.S. &c.

Mr. Henfrey commences by referring to the memoirs of M. Mirbel on *Marchantia*, &c., and the accompanying note of Mr. Griffith; to M. Lindenberg's Monograph of *Ricciæ*; and to the several publications of Bischoff, Von Mohl, Gottsche and Fitt on the development of the spores of various cryptogamic plants. He briefly describes the development of the little green cellular body found within the pistillidium which becomes the capsule of *Marchantia polymorpha*, and states that from the facts observed and from analogy he is inclined to believe that the young capsule is at first formed of a continuous cellular substance, and that the cells of this tissue become parent-cells, producing new cells within them, which they set free by becoming dissolved, exactly as occurs in the production of the parent-cells of the pollen-grains in the continuous cellular tissue of anthers. M. Mirbel does not appear to have examined the contents of the capsules until this complete separation of the cells had taken place, when he describes them as consisting of minute elongated cells (the young elaters) mingled with small squarish cells (the spores). But Mr. Henfrey found the younger capsules to contain elongated cells alone, and those of two sizes. The whole cavity was filled by such cells apparently radiating from the centre; the narrower cells being interposed between much longer and broader cells of the same form. The former were the young elaters, the latter the parent-cells of the spores.

The young elaters Mr. Henfrey describes as elongated slender

tubes attenuated towards each extremity, and filled at first with an almost colourless coagulable protoplasm. After a short time starch globules are seen within them, which might readily be mistaken for the rudiments of the spiral fibre; but the author believes that the accounts given by some writers of the formation of spiral fibre in spiral vessels from rows of minute granules are incorrect, and have arisen from observation of starch granules lying in rows often running obliquely across the tubes. After a greater enlargement in the length than in the diameter of these cells the starch granules and finally the protoplasm disappear, and faint streaks denoting the nascent fibres are at length visible upon the walls. These gradually become more and more distinct, until in the mature elaters they present themselves in the form of strong flattened bands. In *Marchantia* there are two fibres, the ends of which are confluent at the extremities of the tubes in which they are contained; so that more properly speaking there is but one endless fibre twisted upon itself, which may be represented by a piece of string doubled with its ends united, and twisted spirally upon itself. This is evidently the best possible condition of structure for its purpose of acting as a spring. In unrolling, the fibre tears up the membrane of the walls of the tube, which after the elaters have been discharged is often no longer to be detected.

While the elaters are passing through these stages the larger elongated cells exhibit a very remarkable series of changes, which Mr. Henfrey regards as differing from anything that has yet been observed in analogous structures. They are at first filled, like the elaters, with a delicate colourless protoplasm, in which float exceedingly minute granules, and which is apparently the same substance that occurs in all young cells which increase by self-division. These larger cells soon exhibit transverse streaks of a lighter colour, in consequence of the separation of the protoplasm into a number of distinct portions, and the formation of cross membranes at these places, dividing the tubular cell into a row of cells, all of a square form except the two terminal ones which are attenuated towards the free point. The author could not determine whether the septa were formed by gradual growing in of the membrane, nor could he detect at this period a double membrane, which must, however, exist, to admit of the subsequent separation of the contained cells. Vertical septa are often formed in addition, producing a double row of cells within the tube. About the time when the cells separate from each other, their contents undergo a change, which exactly resembles that which occurs in the contents of the parent-cells and special-parent-cells of pollen when the formation of free cells is about to take place in their interior. The mucilaginous matter, or protoplasm, acquires a deep yellow colour, becomes much thicker, and exhibits a quantity of globular bodies which look like drops of oil. Mr. Henfrey gives his reasons for regarding these appearances neither as drops of oil nor as vesicular cavities, but as globular drops of the yellow protoplasm. Such globules are of various sizes and sometimes occupy half the cavity of the cell, but neither before nor after

their formation was the author enabled to detect the presence of nuclei.

Soon after the separation of these cells their yellow contents exhibit lighter streaks running across, which denote that they are each about to separate into four portions. When these portions are completely isolated and become coated by their proper membranes, they constitute the spores, and are subsequently set free by the solution of the membrane of the parent-cells. Their contents then again become clear and almost colourless, their membrane becomes thickened and of a bright yellow colour, and finally their cavity becomes filled with globules of pretty regular size. No trace of septa dividing the parent-cells into chambers, such as are met with in the special-parent-cells of the pollen, were observed, even when treated with iodine; and when the parent-cells in which the contents had parted into four portions were ruptured at one place, all the contents passed out and the membrane remained as a simple sac. In the ripe spore the author could distinguish only a single coat, which grows out into a tube at one point in germination. During this process the entire spore with its contents becomes colourless, the yellow colour and the globules disappearing; and after a short time chlorophyll vesicles appear, which, on the application of iodine, are seen to be imbedded in a coagulable, colourless protoplasm.

In conclusion, the author again directs attention to the striking circumstance, that throughout the whole course of development he met with no nuclei; neither did he observe nuclei during the development of the spores of *Sphærocarpus terrestris*, which he had also partially traced. Sometimes the globular bodies before alluded to as formed in the yellow protoplasm presented appearances which might be mistaken for nuclei; but careful investigation always led him to believe that these appearances were deceptive; and as he obtained clear and well-defined views of all the various stages with fully sufficient magnifying powers to see nuclei if present, he states that he is compelled to deny their existence here.

A series of illustrative figures accompanied the paper.

December 4.—T. Horsfield, M.D., V.P., in the Chair.

The Meeting having been specially summoned to supply the vacancy in the Council caused by the death of the Bishop of Norwich, and to elect a President in his stead; the Vice-President in the Chair opened the business of the day, and the votes having been taken for a Member of Council, Charles Morgan Lemann, M.D., was declared to be elected into the Council.

The ballot for President having also closed, Robert Brown, Esq. was declared to be elected President.

December 18.—Robert Brown, Esq., President, in the Chair.

The President nominated Thomas Horsfield, M.D., Sir William Jackson Hooker, William Yarrell, Esq., and Nathaniel Wallich, M.D., to be Vice-Presidents for the remainder of the year.

A letter was read, addressed to the Secretary by John Hogg, Esq.,

F.L.S., giving an account of a double variety of the Field Scabious, *Scabiosa arvensis*, L. (*Knautia arvensis*, Coult.), a specimen of which he presented to the Society. The specimen was gathered in a stubble-field at Norton in the county of Durham on the 29th of September, and was the only one seen with a double flower, all the other plants in the field presenting the ordinary flower of the species. The doubling consists in the enlargement of the inner florets to the same size as the outer ones in the ordinary flowers; but the anthers and stamina of the former do not appear to have become abortive as in the outer enlarged florets, and as might have been expected from the similar change in the corolla. In Hooker's 'British Flora,' the species is characterized by the corolla of its outer florets having unequal and of its inner florets equal segments: in this double variety the segments of the inner florets are unequal like those of the outer.

Mr. Westwood, F.L.S., exhibited a small branch of a *Nelis d'hiver* pear grown against a wall in the garden of Mr. Wilmot, Isleworth, covered with a great number of large, solid, woody, gall-like protuberances caused by the punctures of a species of *Aphis* closely allied to the American blight, the twigs in this branch having been completely stunted in their growth, and not exceeding an inch in length, the energy of the tree having been concentrated in the growth of the protuberances. Mr. Westwood pointed out the difference between the real galls (sometimes quite hard and woody in their texture) caused by the punctures of insects and the deposition of eggs, and these pseudo-galls which did not enclose eggs, but were the result of the punctures of the proboscis of insects for obtaining an immediate supply of food. The latter are of great rarity, and Mr. Westwood had never seen any which could be compared in extent to the specimen exhibited, which was moreover covered with a whitish powder discharged from the bodies of the *Aphides*, and with a great number of the skins shed by them during their transformations.

Read a further continuation of Mr. Huxley's Memoir "On the Anatomy of the *Diphydæ*," &c.

ZOOLOGICAL SOCIETY.

May 22, 1849.—Harpur Gamble, Esq., M.D., in the Chair.

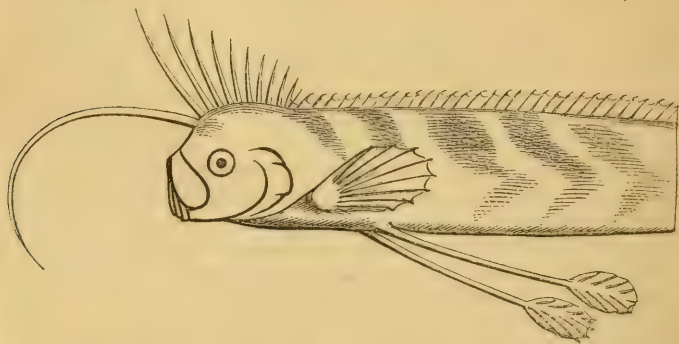
ON THE BRITISH SPECIMENS OF *REGALECUS*. BY J. E. GRAY, Esq., F.R.S. &c.

The occurrence of a specimen of *Regalecus* on the coast of Northumberland, which is now being exhibited in Regent-street, has induced me to communicate the following remarks which I have collected connected with the history of its former occurrence in this country, some of which appear to have escaped the researches of our British naturalists.

Though the materials here referred to are mentioned by M. Valenciennes in the tenth volume of the 'Histoire des Poissons,' the refer-

ence is so indistinct and indefinite that it has not enabled British naturalists to discover where they were to be seen.

On a very accurate drawing of a fish of this genus, bound up with other notes on British fishes, at the end of a 4to copy of Pennant's British Zoology of 1776, which is contained in the library of the late Sir Joseph Banks, now forming part of the library of the British Museum, is the following, the head of which is reduced two-thirds in the following figure :—



"On Saturday the 23rd day of February, 1788, was caught near Newlyn Quay, on the sand at ebb-tide, a fish which measured in length 8 feet 4 inches, breadth 10 inches, and thickness $2\frac{1}{4}$ inches; weight 40 lbs."

The drawing is inscribed, by another hand, "*Regalecus Glesne*, Ascan. Icon. t. 11; Müller, Z. D. n. 355. *R. remipes*, Nov. Act. Hafn. n. 414;" and on the margin there is added in another hand the following note :—

"N.B. A gentleman who saw this fish informed Capt. Chemming (Chelnwyn?) that the tail was not perfect, and supposed it was originally longer than is represented."

The body of the fish is silvered, with obscure indications of darker cross-bands, and the fins are all salmon-coloured; the first ray of the dorsal over the eyes is elongated and bent down over the front of the head, and each of the two ventral fins ends in an ovate radiated appendage.

This figure, representing the first British example on record, is certainly the best and most trustworthy representation of the fish that I have seen. A reduced copy of this drawing is here given.

Valenciennes, to whom a copy of this figure has been sent by Mrs. Lee, mentions it in the History of Fish, vol. x. p. 365, but has translated *Newlyn Quay* into "*Necolyn Quay*."

Dr. Russell (Fishes of Coromandel, i. 29) observes: "In 1796 a fish of this genus was cast on shore in Cornwall, a drawing and description of which were sent to Sir Joseph Banks. It has two ventral cirri, and in the crest of the head resembled the present subject more than any of the others: the tail had been broken off."

Shaw (Zool. iv. 198) observes: "It appears from a print published in the year 1798, that a specimen of this fish (*Gymnetrus Hawkenii*) was thrown on the coast of Cornwall in the month of February in the same year. Its length was 8 feet 6 inches, its breadth in the widest part $10\frac{1}{2}$ inches, and its thickness $2\frac{3}{4}$ inches. The tail in this specimen was wanting; the colour the same as in the specimen (of *Gymnetrus Hawkenii*) figured by Dr. Bloch."

I have no doubt, as Valenciennes suspected (see Hist. Poiss. x. 375), from comparing these accounts with the drawing in the edition of Pennant above quoted, and with Russell's and Shaw's notices, that they are from that authority, and that the two dates in the notes, and the length mentioned by Dr. Shaw, are mistakes of the copyist. I have not been able to find the engraving mentioned by Shaw, which was doubtless made from this drawing, though there is a slight variation in each of the items of the measurements given by the latter author. Could he have considered this drawing as a published print? The writing is so beautifully executed that he might be deceived unless he examined it very carefully.

Mr. Couch, in his paper on Cornish fishes, Linn. Trans. xiv. 77, informs us, under

"*Ceil Conin*.—This fish was drawn on shore in a net at Newlyn (Newlyn) in this country in February 1791. The extremity of the tail was wanting; the length of what remained was $8\frac{1}{2}$ feet, the depth $10\frac{1}{2}$ inches, thickness $2\frac{3}{4}$ inches, weight 40 lbs. A coloured drawing of this fish is in the possession of W. Rashleigh, Esq., F.L.S., of Menabilly."

Mr. Couch has seen this drawing. A copy reduced to one-fourth its size is given by Mr. Yarrell in his excellent work on British Fishes, vol. ii. p. 221.

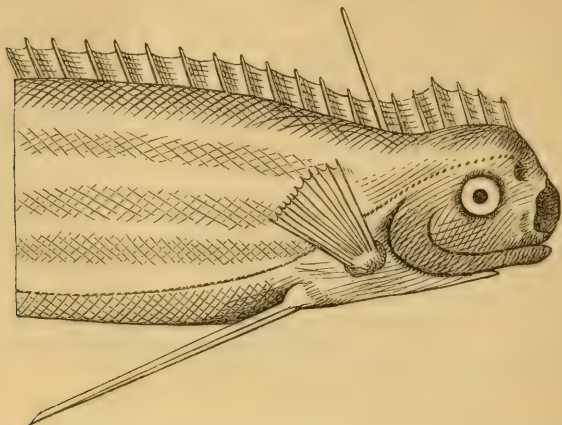
I have great doubt if the fish mentioned by Mr. Couch is not also the same specimen as the one described as caught on 23rd of February 1788, as it is found in the same place, is the same size and weight, &c., and that the date is a mistake. The addition of the two ventral fins was probably a fancy of the artist, like the addition of the tail, the drawing of the fish sent to Sir Joseph Banks being without these fanciful embellishments.

It has been supposed, because the copy of the drawing given by Mr. Yarrell is very like the figure of *Gymnetrus Hawkenii* in Bloch's Hist. Ich. xii. t. 433, that the drawing of the Cornish fish was the origin of Bloch's figure; but it is to be observed that Mr. Hawken sent a specimen as well as a drawing of the fish he received from Goa; that his specimen was only $2\frac{1}{2}$ feet long, and the Cornish specimen $8\frac{1}{2}$ feet. See Cuvier, Hist. Poissons, x. 374.

Dr. Shaw (Zool. iv. 197) informs us that the drawing of *Gymnetrus Hawkenii* was communicated by "J. Hawkins, Esq.;" and he added, "I am assured by Mr. Hawkins that this is really the case (the tail being added by the draughtsman), the specimen from which the drawing was taken having been defective in that part."

From this examination I conclude that these accounts are all from the specimen and figure in Pennant.

In the same copy of Pennant's 'British Zoology' occurs the following note and figure, which is here copied two-thirds the size:—



“ ‘York, March 29, ’96.—On Friday last a curious and uncommon fish came on shore at Filey Bay, and was taken by four women; they sold it to a man who brought it to this city; it was $13\frac{1}{2}$ feet in length, rather more than one foot in depth, and not more than 3 inches in thickness. Its skin was smooth and of a silver hue: had no tail, and its fins were the colour of those of the roach or perch. It may be considered as a nondescript, neither Linnæus, Pennant, or any other writers on Ichthyology having given any description of it.’

“This paragraph is cut from the York Chronicle of last Thursday, and the enclosed I traced from a drawing by Dr. Burgh, who penned the paragraph and made the following notes on his drawing.”—J. F.

“13 feet long, 1 deep, 3 inches thick; head 7 inches long; eye $1\frac{3}{8}$ diam.; no scales, but very small protuberances, silvered over like the swim of a herring; these run the whole length in stripes, alternate with others which are bare, and of a light colour.

“The dorsal fin runs the whole way from the head to the other end, at which there is no tail. The dorsal fin is red, like that of a roach or perch; 6 bronchial rays; dorsal fin 290 and 13 rays; the pectoral 12; ventral 1; no anal. No teeth; a soft tongue. The face and inside of the mouth black. Anus 4 feet 9 inches from the head. Iris a silver-white. He ran on shore at Filey Bay, March 18, 1796; was seen by four women, who took him and sold him to a man who brought him to York, where on March 21 I saw him. Though there was then no caudal fin, it is not clear that he never had one, for there was an appearance of mutilation in its place. The two sides were precisely alike. The eye in the drawing is placed a little too low.”—W.B.

This description is mentioned by M. Valenciennes in his ‘Histoire des Poissons,’ x. 365, under the name of *Gymnetrus Banksii*; nothing is said of the figures which accompanied the letter. I can see nothing

in the account or figures to induce me to believe that it is different from the *Regalecus Glesne*, or the specimen from Cornwall.

Mr. Yarrell, in his letter to Mr. Whitehead, printed in Dr. Jacobs's account of the Northumberland specimen, p. 10, gives the description of a specimen which was caught in March 1844, at Crovie, near Macduff, in Scotland, sent by Mr. John Marten of Elgin to Dr. George Johnston and Mr. Yarrell.

It would therefore appear that the specimen from the coast of Northumberland is at least the fourth time that a fish of this genus has been recorded as found on the coast of Britain.

From the comparison of the various descriptions and figures given by the English observers, and those given by Ascanius, Brunnich and Lindroth, I believe there is only a single species yet found in the North Sea, and it appears that that species occasionally comes as far south as the coast of Cornwall.

The great distinction between *Regalecus Glesne* and *R. Grillii* is the number of the rays in the dorsal fin; but as Valenciennes justly observes, that Ascanius's figure represents more rays than he describes the specimen to have had, and in this respect it agrees with the description of *R. Grillii* and with the specimens which have since occurred, I think it probable that the number in the text is a misprint.

Ascanius represents the five longitudinal streaks mentioned in the description of the Filey specimen.

Mr. Whitehead's specimen agrees with the one from Filey, in having the five convex longitudinal lines. These lines are shown in the painting made from the fish when more fresh, but they are not so distinct in the specimen in the fluid; yet they have been rendered more visible than when I first saw it by some glass which had been put on the specimen to sink it in the fluid.

The black bands so well marked in the painting of this fish were also observed in the specimen cast ashore at Crovie, near Macduff, in March 1844, described by Mr. Marten, and in *Gymnetrus Grillii* of Lindroth; and they are indistinctly represented in the drawing of the Cornish specimen.

The ventral fins in Mr. Marten's specimen "consisted of two filaments 3 feet in length; they were fringed with a thin membrane on two sides, and had evidently been broken."

This shows the affinity of the black-striped fish with the *Glesne* of Ascanius and the *S. Grillii* of Lindroth, and I have no doubt that the slight dilatation at the end of the ventral fins in his figure is a mere enlargement of the membranous fringes above described.

The following appear to be the synonyma of this species:—

REGALECUS GLENE.

1. *Ophidium Glesne*, Ascanius, Mem. Soc. Copenh. iii. 419.
Regalecus Glesne, Ascanius, Icon. ii. t. 11. cop. E. M. t. 358;
 J. J. (J. Jacob), An account of the rare fish, &c. 8vo, 1849,
 figures Illustrated London News, June 2, 1849, p. 384 fig.
Regalecus remipes, Brunnich in Nya Saml. iii. 414. t. 13. f. 4, 5;
 copied by Walbaum, t. 3. f. 4.

Gymnetrus remipes, Schneider, Syst. Ichth. 482. t. 88, altered from Ascanius; copied by Yarrell, Brit. Fish.

Regalec Glesne, Lacep. ii. 214, 215.

Gymnetrus Ascanii, Shaw, Zool. iv. ii. 1. t. cop. from Ascanius.

Le Gymnetre Glesne, Valenciennes, Hist. Poissons, x. 365 & 366.

From the figure of the Newlyn specimen.

2. *Gymnetrus Grillii*, Lindroth, Kongl. Vetensk. Acad. Nya Handl. 1798, 288. t. 8 (from a dry fish); Schneider, Syst. Ichth. 482; Valenciennes, Hist. Poissons, x. 370.
3. *Le Gymnetrus Banksii*, Valenciennes, Hist. Poissons, x. 365. From the letter respecting the Filey specimen.
4. *Ceil Conin* = *Gymnetrus Hawkenii*, Couch, Trans. Linn. Soc. xiv. 77. part.; Yarrell, Brit. Fish. 221. part. From the Newlyn specimen (not Bloch, Ich. xii. t. 423?).
5. *Gymnetrus Northumbrius* (Hancock's MSS.?), 1849.
Gymnetrus —? Marten in Jacobs's Account of Rare Fish, 1849, p. 10.
6. *Sea Serpent*, Ladies' Newspaper, 12th May, 1849.

M. Valenciennes, by mistake, thinks that Ascanius described this fish first as *Regalecus*, and then as an *Ophidium*, but 1766 comes before 1772. The specific name of *Glesne* is derived from the name of the place on which the fish was found, near Bergen in Norway.

The generic name of *Regalecus*, characterized in 1772, has the undoubted priority over *Gymnetrus* of Schneider, and therefore ought to be used; neither are quite unexceptionable, the one being a mixture of Greek and Latin, and the latter as conveying a false character, for the fish has ventral fins; but I think it is not desirable to change names which have once been used for such reasons, though it is well to avoid giving names having the first objection, and the second should always be avoided.

The Banksian copy of Pennant is very valuable to the British zoologist, and contains, besides the figures and letters here referred to, some shorter notes, the titles of which I here give, as they may be of use to persons residing at a distance from the library.

Vol. I. Aylmer Bourke Lambert, letter on the Irish Wolf Dog.

P. 224. Note on Grouse.

P. 346. Mr. Pearson of Newport Street, account of keeping Swallows through the winter.

Letter from James Hervey of Manchester, on the arrival of Swallows.

P. 352 List of indigenous Mammalia and Birds that are wanting to the British Museum, by W. E. Leach, M.D.

The price of Heronshaws in 1556.

A Fenman's List of the Fowls found in the East Fen.

Vol. II. p. 357. Letter from T. J. Woodward of Walcot, respecting the Heron with the crest.

Vol. III. p. 109.—1. A figure of a short Sun-fish, inscribed "Portrait of a Sun-fish for Sir Joseph Banks, Bart., from his obliged and humble serv^t Richard Brocklesby."

P. 137.—2. A beautiful drawing of a Launce, by “W. W. Ellis, ad viv. delin. et pinxt. 1779.”

P. 138.—3. A letter from L. Morris, accompanied by a pen sketch of the ‘Morris’ *Leptocephalus*, copied from a blank page in Lewis Morris’s Ray Synopsis, by Mr. Lloyd, at Aberystwith, 1786. This note is copied into the edition of ‘Pennant’s Zoology’ for 1812, p. 215, where the editor observes: “The above memorandum is preserved in the copy of the British Zoology in the valuable library of the President of the Royal Society in Soho Square.” The editor does not notice any of the other papers in the Banksian copy of Pennant.

P. 178.—4. A note about the name of the *Torse*.

P. 187.—5. Sir William Musgrave’s note accompanying a Spotted Goby and a young Angel Fish.

P. 213.—6. Hugh Davies’ reply to Donovan respecting the trifurcated Hake, from the North Wales Gazette, March 1810.

P. 213.—7. Moses Griffith in reply to Donovan, from the Cambrian, Dec. 30, 1809.

P. 372.—8. The description of three fish, accompanied by very good figures in India ink, probably by Colonel Montague (?).

Viz. 1. *Leptocephalus Morrissii*.—I may observe, that on the continent they apply this name to a species which is much longer and more slender than the one figured by Pennant and Yarrell, and Costa has given the name of *L. candidissimus* to the shorter British species; we have both species from Costa in the British Museum.

2. *Cæpola rubescens*.

3. The Variegated Sole, *Solea lingula*. In the MSS. it is stated, “This fish is sometimes taken in Torbay in the trawling-nets. It differs at first sight from the common sole in the edges of the scales being strongly ciliated, and in wanting the numerous small beards that hang from the lower side of the head of the common sort.” This appears to be the Red-back described from E. Hanmer’s MSS. in the 1812 edition of Pennant, but there is no reference to this figure.

9. The letter from J. F. respecting the fish from Filey Bay, *R. Banksii* of Valenciennes.

10. The drawing of *Regalecus Glesne* from Newlyn Quay.

I may also mention, that in this copy of Pennant the plate 93, called *Ōphidium imberbe*, Brit. Zool. App. iii., is marked in pencil, apparently by Dr. Solander, as being “*Muraena Anguilla*.” This probably explains why the figure is replaced in the edition of 1812 by Montague’s figure from the Wernerian Transactions, as mentioned by Yarrell, Brit. Fishes, 412 & 414, where these two figures are copied.

Since this paper was read, there has appeared in the ‘Annals of Natural History’ a full description of Mr. Whitehead’s specimen, and an account of some other specimens found on other parts of the English coast.

BOTANICAL SOCIETY OF EDINBURGH.

April 11, 1850.—Professor Fleming, President, in the Chair.

Dr. Greville made the following report on fibrous matter from the Edinburgh Water Company's works, presented at the last meeting by Mr. M'Nab, and on a similar substance found on an old wheelbarrow in Dundee, by Mr. W. Ogilvie :—

“The fibrous substance from the Water-works is *Ozonium auricomum* of Link. Along with a number of other fibrous and byssoid productions, it is now regarded as either an imperfectly developed or aberrant form of some fungus. *Ozonium*, *Himantia*, *Fibrillaria*, *Acrothamnium*, *Byssocladium*, &c., are considered by Fries as the *Mycelia* of Hymenomycetous Fungi, in a more or less monstrous state. I am not aware that the full development has ever been traced, so that the species has not been identified.

“The specimens from an old wheelbarrow are probably the same plant. Having been more favourably placed, there is evidently an approach to a higher development.”

Dr. Balfour stated that he had received from Mr. James Kay, Belurbet, Ireland, a specimen of *Orthotrichum* with peculiar conferva-like bodies on the leaves. These had been examined by Dr. Greville, who reported as follows :—“The productions sent by Mr. Kay are common on *Orthotrichum crispum*, and more or less on *O. Lyellii*, and one or two other species. They arise often singly from various parts of the leaves, and in *O. Lyellii* are scattered all over them. Hooker and Taylor in ‘*Muscologia Britannica*’ regard them as a *Conferva* (*C. Orthotrichi*), and Bridel as a sort of gland. But Bruch and Schimper consider them as secondary radicular filaments, which may also be observed along the whole length of the stems. They will be found figured in both a simple and branched state, in tab. 16 of ‘*Bryologia Europæa*.’ I believe the view of these authors to be the true one. The singular mass found at the apex of the leaves may be regarded as analogous to the radiating apices of the fronds of some ferns. But it is difficult to account for their appearance in *O. crispum* at a particular stage of growth, which seems to be the case; and I am besides under the impression that they are not found on specimens in female fructification.”

Mr. M'Nab showed a specimen of *Ranunculus Ficaria*, raised from roots which had been gathered in Silesia by the Rev. Mr. Wade in 1848. These roots had been exposed over a large extent of country by heavy rains, and the people gathered them and used them as food. Their sudden appearance gave rise to various conjectures as to their nature and origin, and in the Austrian newspapers they were spoken of as having fallen from the sky. They were used as peas by the inhabitants. Mr. M'Nab had tasted the dried specimens as well as fresh roots of *Ranunculus Ficaria* gathered in this country, which, after being boiled, he found very amylaceous. There is no acidity in the roots even in their fresh state.

A paper was read on Indian Hemp (*Cannabis indica*), by Alexander Christison, Esq. (see p. 483.)

Mr. McNab made the following report on the flowering of the plants in the open borders of the Royal Botanic Garden, Edinburgh.

Date.	Lowest point of therm. during the night.	Names of plants in flower.
March	15. .. 40° ..	<i>Saxifraga oppositifolia</i> , <i>Adonis vernalis</i> .
	16. .. 37 ..	<i>Corydalis solida</i> , <i>C. cava</i> .
	18. .. 32 ..	<i>Muscari botryoides</i> , <i>Orob. vernus</i> .
	19. .. 35 ..	<i>Geum altaicum</i> , <i>Lamium maculatum</i> , <i>Tritonia media</i> , <i>Anemone nemorosa</i> .
	20. .. 37 ..	<i>Fritillaria imperialis</i> , <i>Gagea lutea</i> , <i>Saxifraga crassifolia</i> .
	21. .. 39 ..	<i>Primula Auricula</i> , <i>P. marginata</i> , <i>Alopecurus nigricans</i> , <i>Corydalis capnoides</i> , <i>Aubretia deltoidea</i> .
	22. .. 29 ..	<i>Saxifraga virginica</i> , <i>Geum pyrenaicum</i> , <i>Erigeron villosus</i> , <i>Primula villosa</i> .
	24. .. 23 ..	<i>Aubretia grandiflora</i> , <i>Orob. venosus</i> , <i>Narcissus pseudo-Narcissus</i> , <i>N. moschatus</i> .
	25. .. 29 ..	No plants observed to flower.
	26. .. 26 ..	No plants observed to flower.
	27. .. 22 ..	<i>Omphalodes verna</i> .
	28. .. 25 ..	No plants observed to flower.
	29. .. 35 ..	No plants observed to flower.
	30. .. 37 ..	<i>Dalibarda geoides</i> .
	31. .. 38 ..	No plants observed to flower.
April	1. .. 42 ..	<i>Hesperis arabidifolia</i> , <i>Viola pulmonensis</i> .
	2. .. 44 ..	<i>Narcissus bicolor</i> , <i>N. incomparabilis</i> , <i>Pulmonaria angustifolia</i> .
	3. .. 45 ..	<i>Alyssum saxatile</i> , <i>A. montanum</i> , <i>A. apenninum</i> , <i>Orob. flaccidus</i> , <i>Pulmonaria virginica</i> .
	4. .. 44 ..	<i>Pulmonaria officinalis</i> , <i>Euphorbia pilosa</i> , <i>Cardamine bellidifolia</i> , <i>Draba rupestris</i> , <i>Hierochloe borealis</i> .
	5. .. 38 ..	<i>Asphodelus tauricus</i> , <i>Carex stenophylla</i> , <i>C. pilosa</i> , <i>Euphorbia epithymoides</i> , <i>Orob. canescens</i> .
	6. .. 39 ..	<i>Anemone hortensis</i> , <i>Narcissus stellaris</i> , <i>Doronicum Pardalianches</i> , <i>Prunus Cerasus</i> .
	8. .. 45 ..	<i>Scilla italica</i> , <i>Lunaria vesicaria</i> , <i>Hyacinthus orientalis</i> .
	9. .. 42 ..	<i>Potentilla opaca</i> , <i>Narcissus pallidus</i> , <i>Carex montana</i> .
	10. .. 43 ..	<i>Narcissus poeticus</i> , <i>Fritillaria Meleagris</i> , <i>Carex pilosa</i> , <i>Helonias bullata</i> .

MISCELLANEOUS.

On Scolicia prisca, a Fossil Annelide of the Chalk.

By A. DE QUATREFAGES.

THE whole line of coast of the bay of St. Sebastian is formed of laminated rocks belonging to the great cretaceous formation of the Pyrenees. At one of the points of this bay, near the chapel of Antigua, I found some very remarkable impressions evidently belonging to an Annelide of enormous size. Similar impressions are met with on the opposite rocks at the foot of the hill on which stands the lighthouse. It is at this latter locality that I collected the specimen of which the following is a brief description. The slab which I brought with me, and which now forms part of the collection of the Museum, is about 0.50 metre in length by 0.45 in breadth. Its surface is traversed in

several directions by the folds of the impression of the animal. Although neither head nor tail can be detected, and this Annelide is consequently far from being entire, these convolutions correspond to a length of about 2·20 metres.

The body appears to have been about 0·04 metre broad; its segments are thick. At some places there are externally some indentations, which appeared to me to have arisen rather from some folds of the body than from true feet. The smooth outline of the greater portion of the impression leads me to think that this Annelide was apodous. Within the segments of the body the interannular dissepiments are distinctly visible; they are as close together as in our large species of *Eunices*. These imperfect septa do not reach the intestine. The space separating them communicates with the general cavity of the body, which is perfectly distinct. In the centre of this cavity is seen the intestine, which is free and extends the whole length of the body. It varies in diameter generally from 0·005 to 0·009 metre. It is folded transversely, and these folds have nearly everywhere an imbricated appearance; but at some points where this intestine is distended transversely, and where it has acquired almost 0·015 metre in diameter, these folds are seen not to reach from one side of the intestine to the other, and form rhomboids.

The common cavity of the body evidently contained no other organ. This circumstance consequently removes this Annelide from the *Lumbrici*, the *Hirudines*, and the *Nemertes*. It appears probable to me, that the existing group to which it comes nearest is that of the Annelides Errantes.

The number of fossil naked Annelides is very small. None of the specimens known furnish any idea of the anatomy of these ancient inhabitants of the primitive oceans. On this account the specimen from the bay of St. Sebastian appears to me of considerable importance.—*Ann. des Sci. Nat.*, Nov. 1849.

Description of a new species of Gorgonia from Australia.

BY J. E. GRAY, ESQ., F.R.S.

PRIMNOA AUSTRALASIE.

Coral elongate, unbranched, rather tapering; cells numerous, regular, placed in close regular circles round the stem, each formed of two series of imbricate calcareous scales.

Inhab. Australasian seas, on oyster-shell and stones.

Several specimens of this very interesting coral were sent to the British Museum by the Royal Society of Van Diemen's Land.

This coral is often covered with various species of smaller *Coralines* and *Algæ*. It varies from two to three feet in height. The axis is known from the unbranched species of *Gorgonia* by being more calcareous, and of a pale greyish colour.

Joseph Millingin, Esq., F.L.S., the Secretary of the Royal Society of Van Diemen's Land, has kindly sent me the following particulars of this coral:—

“It was fished up from a depth of some fathoms in D'Entrecasteaux Channel, between the mainland of Tasmania and Bruce's Island. It is found, as you will see, affixed to rocks and stones, and to dead,

broken and half-decayed oyster and scallop-shells, &c. It usually exists in groups or families, varying from three to four to a great many. The long delicate stem, which is horny-looking and highly elastic when dry, varies from the thickness of a knitting-wire to that of a crow-quill, and from its mineralized and root-like attachment, tapers gradually and gracefully to the beautiful acicular point, attaining not unfrequently a length of two or three feet, and having its entire surface covered with a calcareous coat of a cream-yellow colour, delicately annulated, so as much to resemble the fine string of wooden beads worn as a necklace by the poorer natives of Bengal, but with this difference,—that in the coralline the beads form a connected or rather continuous chain, independently of the delicate elastic centre upon which the mineral structure is deposited. I am informed that in one or two instances, when these corallines were procured, they were enveloped throughout with a mucilaginous or jelly-like substance, which when they become dry is exsiccated and shriveled to such a degree as to be scarcely if at all traceable. You will be able to say whether you consider it likely that there exists, in the recent and living state of the zoophyte, such an external and soft organization.”

This jelly-like substance was doubtless the polypes.—*From the Proceedings of the Zoological Society for Nov. 27, 1849.*

YELLOW RAIN.—DISTRIBUTION OF PLANTS.

To the Editors of the Annals of Natural History.

The Willows, Swansea, May 21st, 1850.

GENTLEMEN,—If the following extract from my note-book is worthy of insertion, as likely to interest your readers, or to add one more fact towards the elucidation of the still vexed question of the distribution of plants, it is at your service.

“1850, April 17. Yellow rain fell at the Mumbles at 11 A.M.; leaving spots like ochre. Wind S.W. Weather fine. No clouds. Greenhouse roofs, evergreens, and parties who were out of doors, sprinkled over with spots of the above colour, which are found in my garden here (5 miles N. of the Mumbles), at Penclawd (7 miles N.W.), and at many intermediate places.

“May 11. Notwithstanding the marked changes in the weather, including very heavy rain, many spots still remain, some not much changed in colour. They are perceptible to the finger, and with a lens show a globular structure: the $\frac{1}{4}$ -inch shows oval, boat-shaped and round echinulated substances.

“May 12. Letter from one of our most acute observers, Mr. Berkeley, to whom I had sent specimens:—

“The yellow spots consist principally of pollen-grains, probably those of some *Salix* I believe that there are three bands as seen from above, and a single one when the grains are seen laterally, which agrees with *Salix* I find also traces of fungi among the grains, but cannot tell exactly what species.

“May 21. Most of the spots at the Mumbles faded, but some still yellow.”

MATTHEW MOGGRIDGE.

Popular Impressions in India regarding the Natural History of certain Animals. By H. TORRENS, Esq., B.A., &c.

The singular impressions current among natives even of the highest rank, as to the habits and nature of certain animals, are not undeserving of record. It is rarely that the credence of the narrators in these things can be elicited, if even they go so far as to mention the existence of the belief; for they dread the ridicule as much as they anticipate the incredulity of a European: consequently these strange stories are but imperfectly known, even to the best-informed among us in such legends. I mention one or two, with the circumstances of my acquaintance with them.

While out tiger-shooting with a party of Musalman gentlemen, I was asked, in a confidential way, whether I had ever seen the *phnew*: I spell the word with the almost indescribable nasal aspirate with which it was invariably pronounced to me. With an air of grave and serious interest, which is the best way of inspiring confidence, I replied that the nature of the thing or being was unknown to me, and I requested information on the subject. On this there was a little hesitation, when after a time it was explained, that as I had seen more of tigers than my companions, they fancied I might have also seen or heard something of the animal that always preceded the tiger, called *phnew*, from the ceaseless iteration of a sound similar to its name. I required further enlightenment as to this creature, when I found it was a "something that preceded the tiger by six cubits, wherever he went, making the noise *phnew* without end, looking for things for it." The old tales of '*the lion and his provider*' recurred to me at once; and I bethought me of the hospitality of some cat-like sound of *Felis tigris* having led, during his nightly search for prey, to the creation of the story. I have done all I could, but in vain, to discover whether there were real grounds for the belief, based on such a habit of the animal. I killed several tigers in company with my friends afterwards, but though we found no *phnew* with any of them, the silent faith of my believers in the marvellous has remained unshaken as to the existence of the mysterious animal. I subsequently learned that there is in Bengal a like belief respecting it among the Hindus, who term the creature *ghóg**.

There are few Englishmen in India who have not perhaps heard some of the strange tales related by the natives regarding serpents. The most remarkable to me has always been the belief in the *Raj Samp*, or king snake, who is represented as belonging to a superior order of serpent, as exacting homage and obedience from his ophite subjects, and sometimes, as appearing with the semblance of a crown, the type of his authority. I was one day in company with a number of native gentlemen, when the conversation turned upon the nature of antidotes in the case of snake-bites, the belief as to the cure effected by applying to the wound the head of the identical reptile that had inflicted it, the charms powerful to compel the snake to ap-

* According to Babu Rajendralál Mitra, the Hindus distinguish the *Ghóg* as a different animal from the *P'heu*.—E. Blyth.

pear,—as to all which matters I have never been able to obtain, amid many tales, any relator daring enough to declare himself an eye-witness of the marvels he recounted. At last, mention being made of the king snake, a party present said,—“At any rate I can assure you of the existence of *him*, for it is well known that I have seen,” and the story to the following effect was then told. The narrator, being at that time, he said, about fourteen years old, had run hastily to the terraced roof of a ground floor house to recover his kite, when his attention was attracted by a large *goomna* (cobra capello), which, without perceiving him, raised itself with dilated hood in the erect attitude common with those snakes, and uttered a loud cry. Immediately some ten or twelve snakes appeared from different quarters, and assembled before their king; when after a short time he pounced upon and devoured one of the smaller ones, with which arbitrary assertion of regal power the convocation terminated. Now the narrator of this tale had no interest in attempting to mislead me; he had mentioned what he stated again and again to the majority of persons present, for years before I ever saw him; and he is naturally of intelligence, and in no sort the man to tell a useless falsehood. It is, I was then informed, by these sort of assemblages that the king snake asserts his power, and that his subjects are called to him for the purpose of bringing tribute, in the shape of dainties for the royal palate; should however no tributary frog, or cat, or bird be forthcoming, or should even the offering produced be insufficient, one of the luckless ophids pays in person the penalty of the omission,—even as had been witnessed by my informant.

I ventured with respect to his story to object, in as delicate a way as I could, to the incident of the cry uttered by the king snake, but in this I was immediately over-ridden. The cry of the large *goomna* was well-known in the ruinous city where we were, and in which they abound, and it was described to me as a strident sound, the attempted imitation of which resembled the acute staccato note of a treble haut-boy. I heard this sound myself subsequently during a sleepless night, emitted by a large snake which killed a rat in my bed-room: as it was pitch-dark I was unable to rise and destroy the intruder, but the sound was too peculiar not to have been that of the ophid, according as it did with the description given me, and being unlike anything I ever heard before, as also contrasting distinctly and remarkably with the cries of its victim.

I have noted down these trivial, but not incurious matters, as an inducement to the record of more valuable facts as to the opinions held by natives upon the habits of animals, whence perhaps some really useful information may be elicited.

NOTE by Mr. Blyth.—The snake which I have had invariably pointed out to me as the *Raj Samp*, by natives of Bengal, is *Bungarus annularis*, which habitually preys upon other snakes, and is currently said to be a deadly enemy of the Cobra. I have taken a *Tropidonatus umbratus* about two-thirds the length of its devourer, from the stomach of this species, and the specimen is stuffed in the Society's Museum as in the act of seizing its victim which it had swallowed.

Another ophiophagous species, with the Cobra hood, is *Hamadryas hannah* of Cantor, or *Maia vittata* of Elliot; a specimen of which (9 feet long, and now mounted in the Museum) I obtained in the Midnapore jungle.

Mr. Layard some time ago informed me of a popular notion among the natives of Ceylon respecting a "horn" which is said to grow sometimes, but very rarely, on the forehead of the jackal; and this horn is regarded by them as a specific of innumerable virtues. Strange to say, the same notion is equally current among the natives of Bengal, who believe that it ensures the prosperity of its possessor, and success in every undertaking.—E. B.—*Journal of the Asiatic Society of Bengal*, No. 206, Aug. 1849.

On Cypræa umbilicata and C. eximia of Sowerby.

By J. E. GRAY, Esq.

Cypræa umbilicata was described from a single specimen which was formerly in the Tankerville Collection and is now in the British Museum. From its external resemblance to some specimens of *Cypræa Pantherina*, some peculiarities in its formation, and especially from certain apparent irregularities in its teeth, it has been thought that it might be a monstrosity or irregular growth of that species.

The discovery of the habitat by Mr. Gunn, who has kindly sent two specimens of the species to Europe, has removed this impression, and shown that it is a distinct species; and that what was regarded as the irregularities in the plaits of the front of the pillar, is in fact the normal form of the species.

Such being the case shows that the species should be removed from the genus *Cypræa*, as restricted in my monograph in the Zoological Journal, and placed in the genus *Cyprovula*, first described in that work.

The shell, instead of having the single large plait in front of the inner lip separated from other plaits by a wide space, has the front of the inner lip covered with several oblique plaits, nearly up to the front edge of the notch.

It also agrees with *Cyprovula* in the spire being concave or sunken, forming a deep umbilicus.

Cypræa eximia, figured in Strzelecki's 'New South Wales and Van Diemen's Land,' is a very nearly allied species, and equally a *Cyprovula (eximia)*. It differs in the body being more globular and the canal longer. Both these species are to be distinguished from the other *Cyprovulæ* by the canal at each end of the mouths being more developed and produced: they also both have a somewhat angular depression across the upper part of the anterior canal, at the anterior extremity of the dorsal line, evidently formed by the junction of the two expansions of the mantle in this part.

The elongation of the canals, and the depression above referred to, are more developed in *Cyprovula eximia* than in *Cyprovula umbilicata*. They are, especially the latter, the giants of the genus. The original specimen of *C. eximia* is in the cabinet of Mr. John Morris of Kensington.

To give some idea of the extraordinary price which is now sometimes required for shells, I may state that the second specimen of this Cowry, sent home by Mr. Gunn to a London collector, was offered by him to Miss Saul for £30, and eventually realised that price.—*From the Proceedings of the Zoological Society for Nov. 1849.*

THE HIPPOPOTAMUS AT THE ZOOLOGICAL GARDENS.

To the Editor of the Annals of Natural History.

MY DEAR SIR,—I send you a few notes on the newly-arrived Hippopotamus, whilst the impressions of the survey of this truly extraordinary quadruped are fresh in the mind, and thinking they may interest our zoological friends in the country who have not yet had the opportunity of inspecting this great rarity.

The young Hippopotamus was safely housed in the comfortable quarters prepared for it at the Zoological Gardens about 10 o'clock on Saturday night (May 25th), having arrived by special train from Southampton, where it was landed from the 'Ripon' steamer which reached that port early in the morning. The strong attachment of the animal to its keeper removed every difficulty in its various transfers from ship to train, and from waggon to its actual abode. On arriving at the Gardens, the Arab who has had the charge of it walked first out of the transport van, with a bag of dates over his shoulder, and the beast trotted after him, now and then lifting up its huge grotesque muzzle and sniffing at its favourite dainties, with which it was duly rewarded on entering its apartment. When I saw the Hippopotamus the next morning, it was lying on its side in the straw with its head resting against the chair on which its swarthy attendant sat; it now and then uttered a soft complacent grunt, and, lazily opening its thick smooth eyelids, leered at its keeper with a singular protruding movement of the eyeball from the prominent socket, showing an unusual proportion of the white, over which large conjunctival vessels converged to the margin of the cornea. The retraction of the eyeball is accompanied by a protrusion of a large and thick 'palpebra nictitans,' and by a simultaneous rolling of the ball obliquely downwards and inwards or forwards.

The young animal was captured at the beginning of August 1849, on the banks of the Nile about 350 miles above Cairo: it was supposed to have been recently brought forth, being not much bigger than a new-born calf, but much stouter and lower. The attention of the hunters was attracted to the thick bushes on the river's bank in which the young animal was concealed, by the attempt of its mortally wounded mother to return to the spot. When discovered, the calf made a rush to the river, and had nearly escaped owing to the slipperiness of its naked lubricous skin, and was only secured by one of the men striking the boat-hook into its flank: it was then lifted by one of the men into the boat. The cicatrix of the wound is still visible on the middle of its left side: the attendant informed me that the scar was much nearer the haunch when the animal first arrived at Cairo; its relative position has changed with the growth of the body.

The young animal, which we may reckon to be ten months old, is now 7 feet long and $6\frac{1}{2}$ feet in girth at the middle of the barrel-shaped trunk, which is supported, clear of the ground, on very short and thick legs, each terminated by four spreading hoofs: the innermost is the smallest on the fore-foot; the two middle ones, answering to those which are principally developed in the hog, are the largest in both feet. The hind-limb is buried in the skin of the flank nearly to the prominence of the heel. Thick flakes of cuticle are in process of detachment from the sole. There is a well-defined white patch behind each foot, but I looked in vain for any indications of the glandular orifice which exists in the same part of the rhinoceros. The naked hide covering the broad back and sides is of a dark india-rubber colour, impressed by numerous fine wrinkles crossing each other, but disposed almost transversely. When I first saw the beast it had just left its bath, and a minute drop of a glistening secretion was exuding from each of the conspicuous muco-sebaceous pores which are dispersed over the whole integument, at intervals of from eight lines to an inch. This gave the hide, as it glistened in the sunshine, a very peculiar aspect. When the animal was younger the secretion had a reddish colour, and, being poured out more abundantly, the whole surface became painted over with it every time he quitted his bath. The integument is impressed by a groove which passes transversely from shoulder to shoulder; and there are two transverse nuchal folds, crossed by a median longitudinal furrow, the lateral moieties of the strong 'ligamentum nuchæ' forming a pair of well-marked prominences behind the occiput. The ears are very short, conical, fringed with short scattered hairs along the lower half of their thick borders, and beset with a few clumps of short hairs upon the middle of their inner surface. It moves them about with much vivacity. The dark colour of the body extends forwards along the middle of the upper part of the head and more faintly along the cheeks: the skin around the ears is of a light reddish-brown colour and almost flesh-coloured round the eyelids, which defend the peculiarly situated and prominent eyes: there is a single groove or fold above the upper eyelid, and two curved grooves below the lower one. At first sight they seem to be devoid of eyelashes, but on a close inspection a few very short hairs may be seen on the thick rounded margin of the upper lid. There is a caruncle or protuberance on the middle of the outer surface of the nictitating lid. The colour of the iris is a dark brown: the pupil is a small transversely oblong aperture. The eyeball is relatively small, and is remarkable for the extent of the movements of protraction and retraction. The nostrils, situated on prominences, which the animal has the power of raising, on the upper part of the broad and massive muzzle, are short oblique slits, guarded by two valves, which can be opened and closed spontaneously, like the eyelids. The movements of these apertures are most conspicuous when the beast is in his favourite element. The wide mouth is chiefly remarkable for the upward curve of its angles towards the eyes, which gives a quaintly comic expression to the massive countenance. The short and small milk-tusks project a little, and the minute deciduous incisors appear

to be sunk in grooves or pits of the thick gums : but the animal would not permit any close examination of his teeth ; withdrawing his head from the attempt and then threatening to bite. The muzzle is beset with short bristles projecting at pretty regular distances ; several of them appearing to be split into tufts or pencils of short hairs. Extremely fine and short hairs are scattered all over the back and sides ; which are not very obvious except upon a close inspection. The tail is short, rather flattened, and gradually tapering to an obtuse point.

After lying quietly about an hour, now and then raising its head and swiveling its eyeballs towards the keeper, or playfully opening its huge mouth and threatening to bite the leg of the chair on which his keeper sat, the hippopotamus rose and walked slowly about its room, and then uttered a loud and short harsh snort, four or five times in quick succession, reminding one of the snort of a horse, and ending with an explosive sound like a bark. The keeper understood the language, and told us that the animal was expressing its desire to return to its bath. The beast at this time was in one of the compartments of the wing of the Giraffe-house on the opposite side to that in which its bath is prepared. It carries its head rather depressed, and reminded me most of a huge prize hog, but with a breadth of muzzle and other features peculiarly its own. The keeper opened the door leading into the Giraffe's paddock and walked through that to the new wing containing the bath, the hippopotamus following, like a dog, close to his heels. On arriving at the bath-room the animal descended with some deliberation the flight of low steps leading into the water, stooped and drank a little, dipped his head under, and then plunged forwards. It was no sooner in its favourite element than its whole aspect changed, and it seemed inspired with new life and activity : sinking down to the bottom and moving about submerged for a while, it would suddenly rise with a bound, almost bodily out of the water, and splashing back commenced swimming and plunging about with a cetaceous or porpoise-like rolling from side to side, taking in mouthfuls of water and spurring them out again, raising every now and then its huge grotesque head, and biting the woodwork at the margin of the bath. The broad rounded back of the animal being now chiefly in view, it looks a much larger animal than when out of the water. After half an hour spent in this amusement it quitted the water at the call of its keeper, and followed him back to the sleeping room which is well-bedded with straw, and where a stuffed sack is provided for its pillow, of which the animal, having a very short neck, thicker than the head, duly avails itself when it sleeps. When awake it is very impatient of any absence of its favourite attendant, rises on its hind legs, and threatens to break down the wooden fence, by butting and pushing against it in a way strongly significative of its great muscular force. The animal appears to be in perfect health, and breathes when at rest slowly and regularly, from three to four times in a minute. Its food is now a kind of porridge of milk and maize-meal. Its appetite has been in no respect diminished by the confinement and inconveniences of the sea-voyage, or by change of climate. It is more than half-weaned from the milk-diet, which, it is

said, created a scarcity of that article at Cairo; owing to the enormous supply which the cravings of the young animal required, whilst under the fostering care of our excellent Chargé d'Affaires the Hon. Mr. Murray; to whom, after the princely donor, Abbas Pacha, zoologists at home are chiefly indebted for the present opportunity of studying this most remarkable and interesting African mammal, of which no living specimen has been seen in Europe since the period when they were last exhibited by the third Gordian in the Amphitheatre of Imperial Rome.

I remain, my dear Sir, yours very faithfully,

Richard Taylor, Esq., F.L.S. &c.

RICHARD OWEN.

METEOROLOGICAL OBSERVATIONS FOR APRIL 1850.

Chiswick.—April 1. Overcast: rain. 2. Cloudy: clear. 3. Fine: showery at night. 4. Boisterous, with rain. 5. Cloudy and rather boisterous: fine: clear. 6. Overcast. 7. Cloudy and fine. 8. Foggy: overcast: slight showers. 9. Cloudy. 10. Very fine. 11. Rain: showery; overcast. 12. Fine: hot sun: thunder commenced $\frac{1}{4}$ past 12 noon: overcast at night. 13. Hazy: rain. 14. Hazy: rain at night. 15. Rain: very heavy rain in forenoon: cloudy. 16. Showery. 17. Low white clouds: fine throughout. 18. Clear: very fine. 19. Rain. 20. Showery. 21. Slight rain: cloudy. 22. Fine: clear. 23. Overcast: cloudy. 24. Clear: fine. 25. Fine: overcast and cold: clear at night. 26. Cloudy and cold. 27. Fine, but cold. 28, 29. Cloudy: fine, but cold, with excessively dry air. 30. Fine: cloudy.

Mean temperature of the month 48°·41

Mean temperature of April 1849 44 ·29

Mean temperature of April for the last twenty-four years ... 47 ·53

Average amount of rain in April 1·46 inch.

Boston.—April 1. Cloudy. 2. Cloudy: rain P.M. 3. Fine. 4. Cloudy: rain A.M. 5. Cloudy. 6. Cloudy: rain P.M. 7. Cloudy. 8. Cloudy: rain A.M. and P.M. 9. Cloudy: rain P.M. 10. Fine. 11, 12. Cloudy. 13. Cloudy: rain P.M. 14. Cloudy. 15. Cloudy: rain early A.M. 16. Cloudy: rain A.M. and P.M. 17. Cloudy: rain. 18. Fine. 19. Cloudy: rain A.M. 20, 21. Cloudy: rain P.M. 22. Cloudy. 23. Cloudy: rain. 24. Cloudy. 25. Fine. 26—28. Cloudy. 29. Cloudy: rain P.M. 30. Cloudy.

Applegarth Manse, Dumfries-shire.—April 1, 2. Rain, moderate. 3. Rain: mild: heavy P.M. 4. Rain heavy during night: drizzling throughout the day. 5. Rain in the night: dry and windy. 6. Heavy showers all day. 7. Frost: cleared P.M. 8. Rain. 9. Slight shower. 10. Rain in the night. 11. Frost: clear sunshine. 12. Fine day. 13. Fine A.M.: cold and windy P.M. 14. Strong cold east wind. 15. Rain and high wind. 16. Fair and fine: slight drizzle P.M. 17. Fine: shower heavy P.M. 18. Mild: growing shower. 19. Rain early A.M.: fair day. 20. Rain early: showery day. 21. Fair and fine. 22. Cold and clear. 23. Cold and clear: slight frost. 24. Cold and clear: frost A.M. 25. Rain and wind: boisterous. 26. Fair: cold. 27. Fair: clear and cold. 28. Fair A.M.: slight shower P.M. 29. Frost early. 30. Cold: a few drops of rain.

Mean temperature of the month 46°·3

Mean temperature of April 1849 42 ·3

Mean temperature of April for the last twenty-eight years . 44 ·3

Rain in April 1849 2·52 inches.

Rain in April for twenty-three years 1·76 inch.

Sandwich Manse, Orkney.—April 1. Fog: damp. 2. Cloudy: rain. 3. Damp. 4. Rain. 5. Drizzle. 6. Cloudy: hazy A.M. 7. Cloudy: drops A.M. 8. Rain: cloudy. 9. Drizzle: showers. 10. Hazy: clear. 11. Drops: damp. 12. Bright: fine. 13. Cloudy: clear. 14. Clear: cloudy. 15. Drizzle: cloudy. 16. Rain: cloudy. 17. Cloudy. 18. Showers: bright: cloudy. 19. Cloudy: showers: cloudy. 20. Bright: cloudy. 21. Cloudy: drops. 22. Bright: clear. 23. 24. Cloudy. 25. Bright: clear. 26. Cloudy: drops. 27. Clear: fine. 28. Cloudy: fine. 29, 30. Drops: cloudy.

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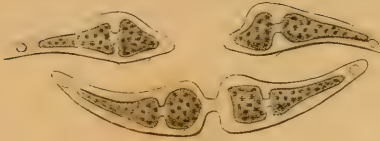


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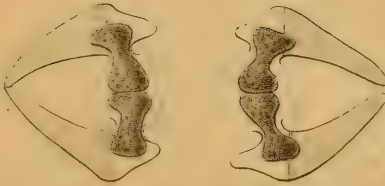


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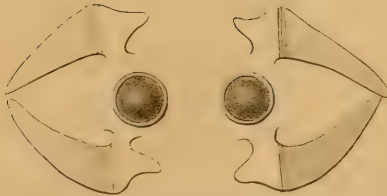
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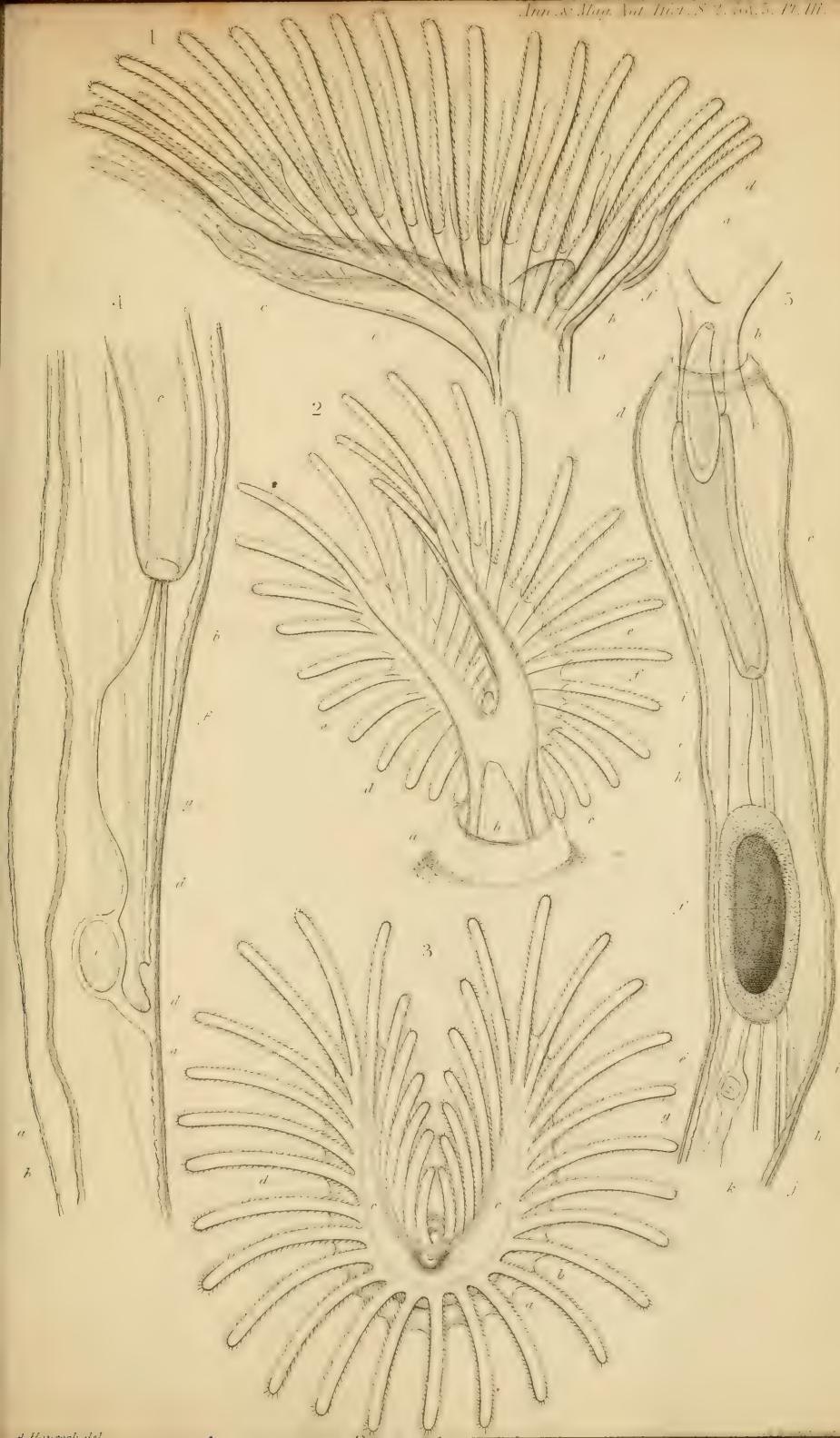
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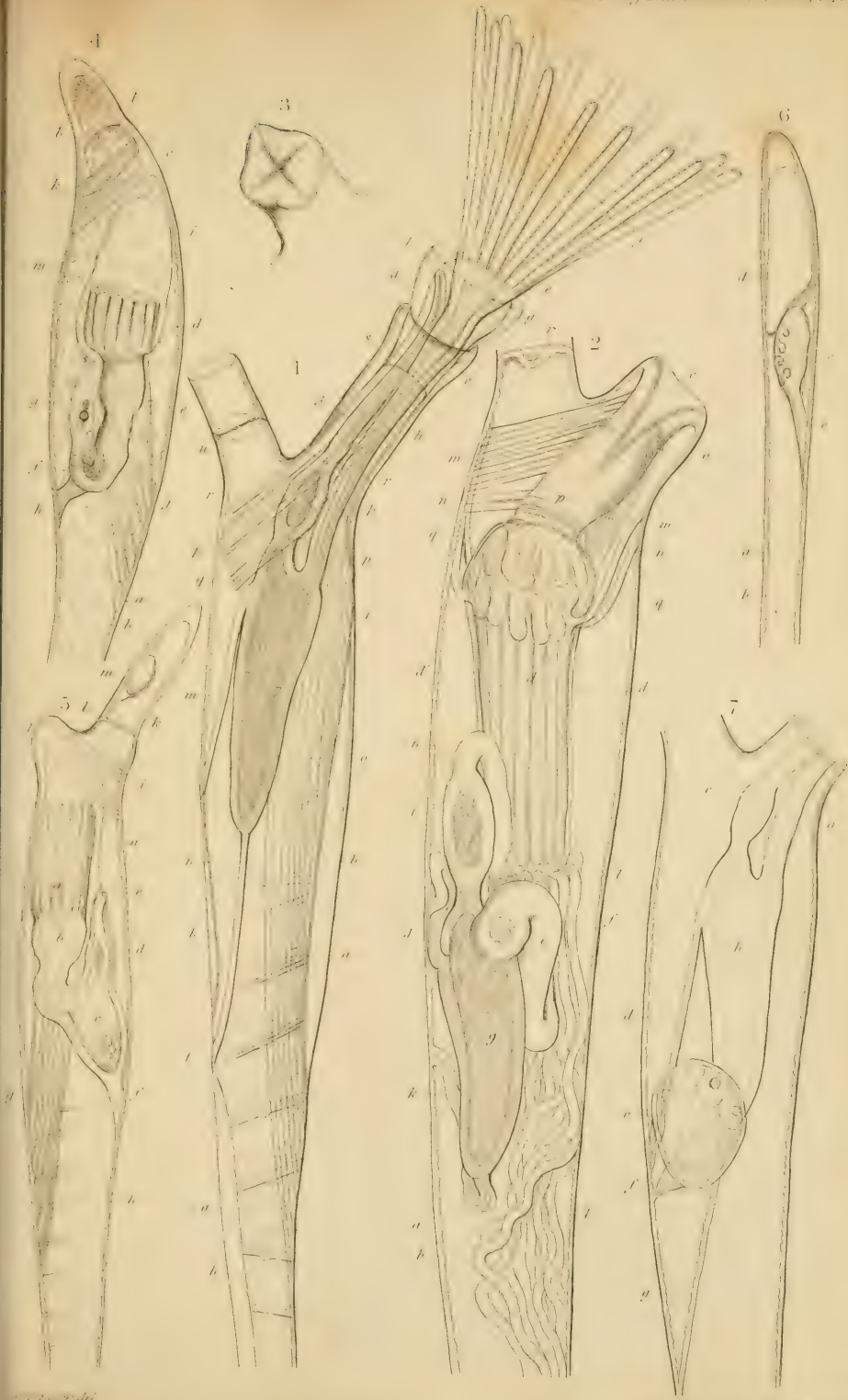
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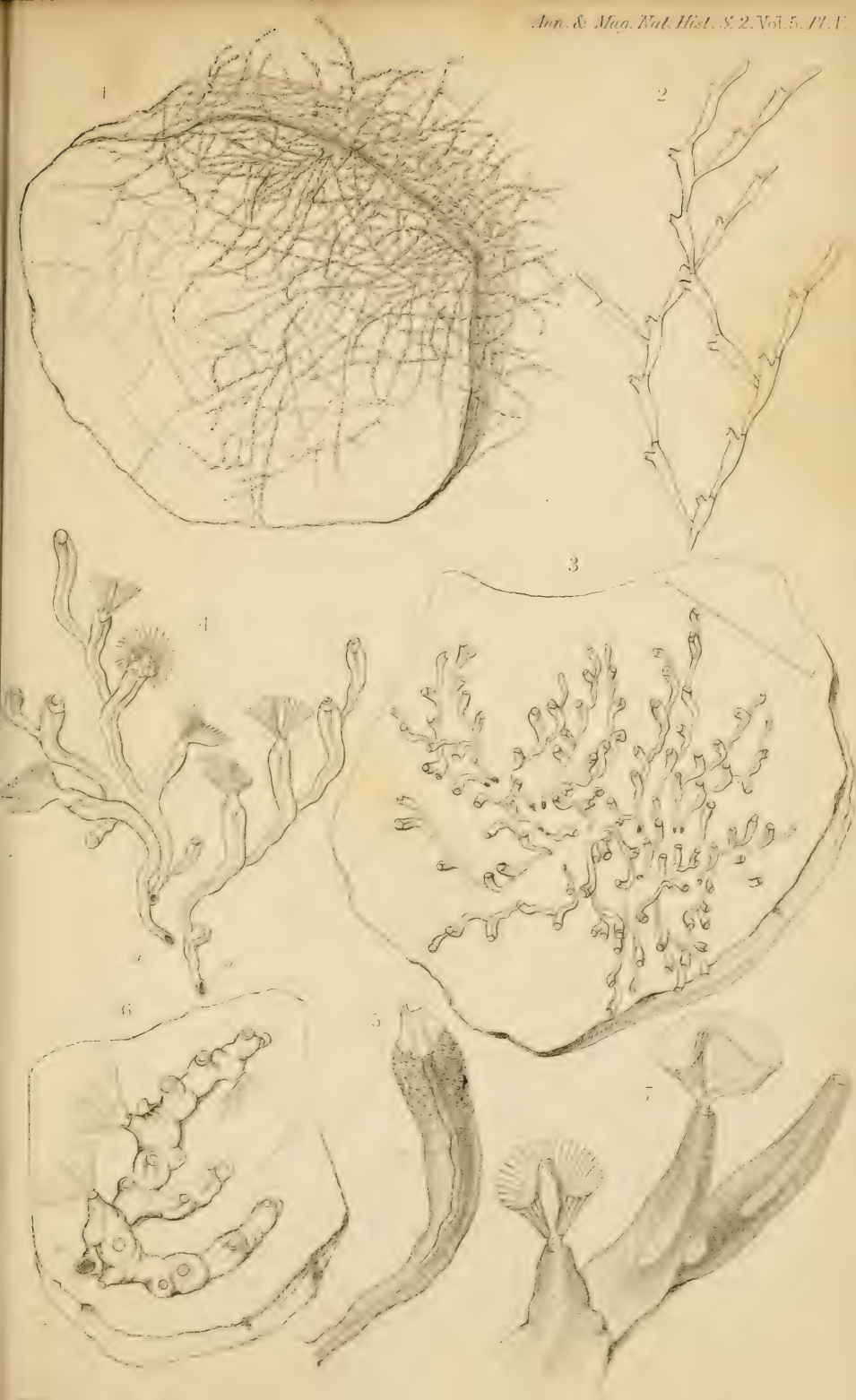
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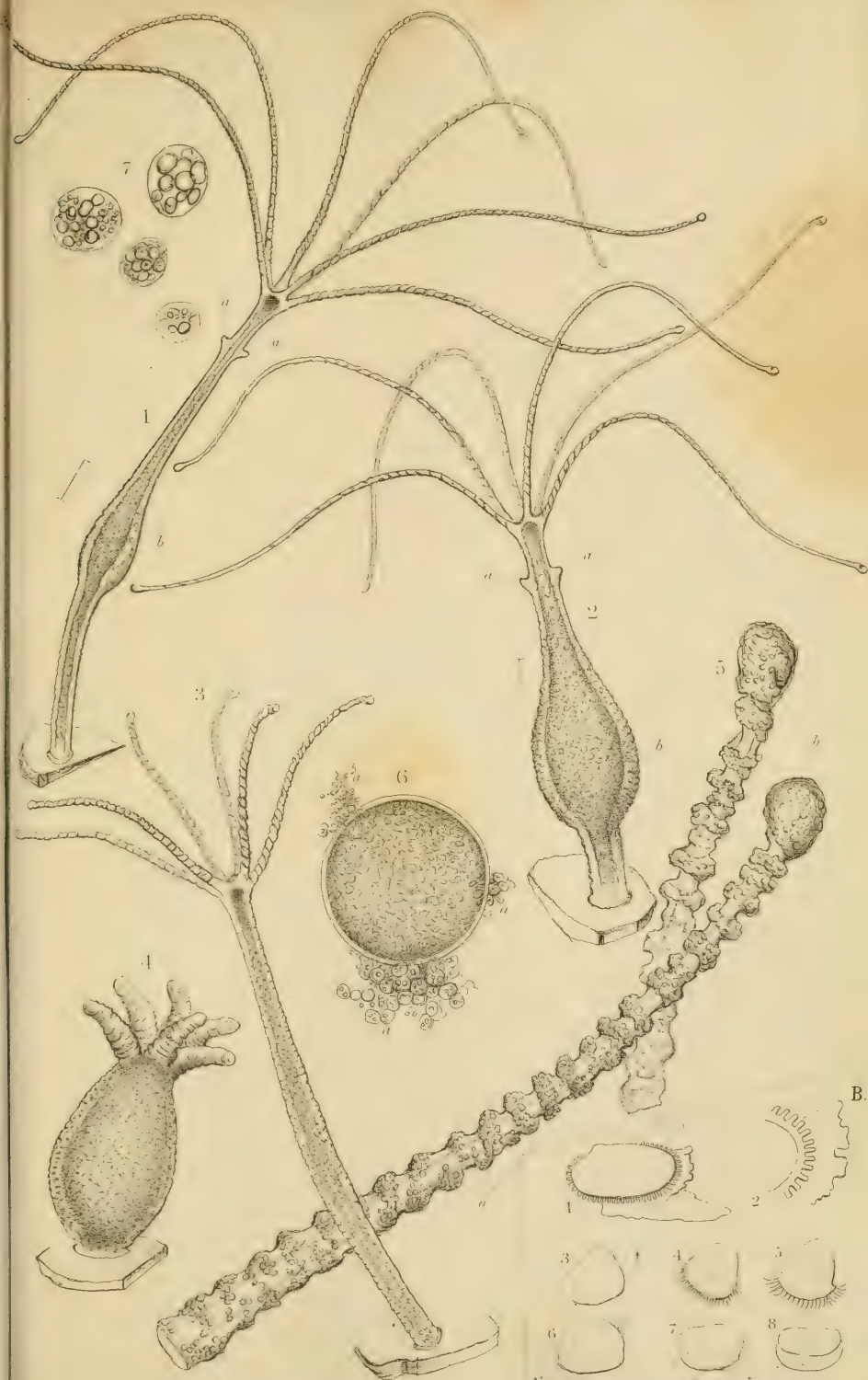
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Montacuta ferruginea.

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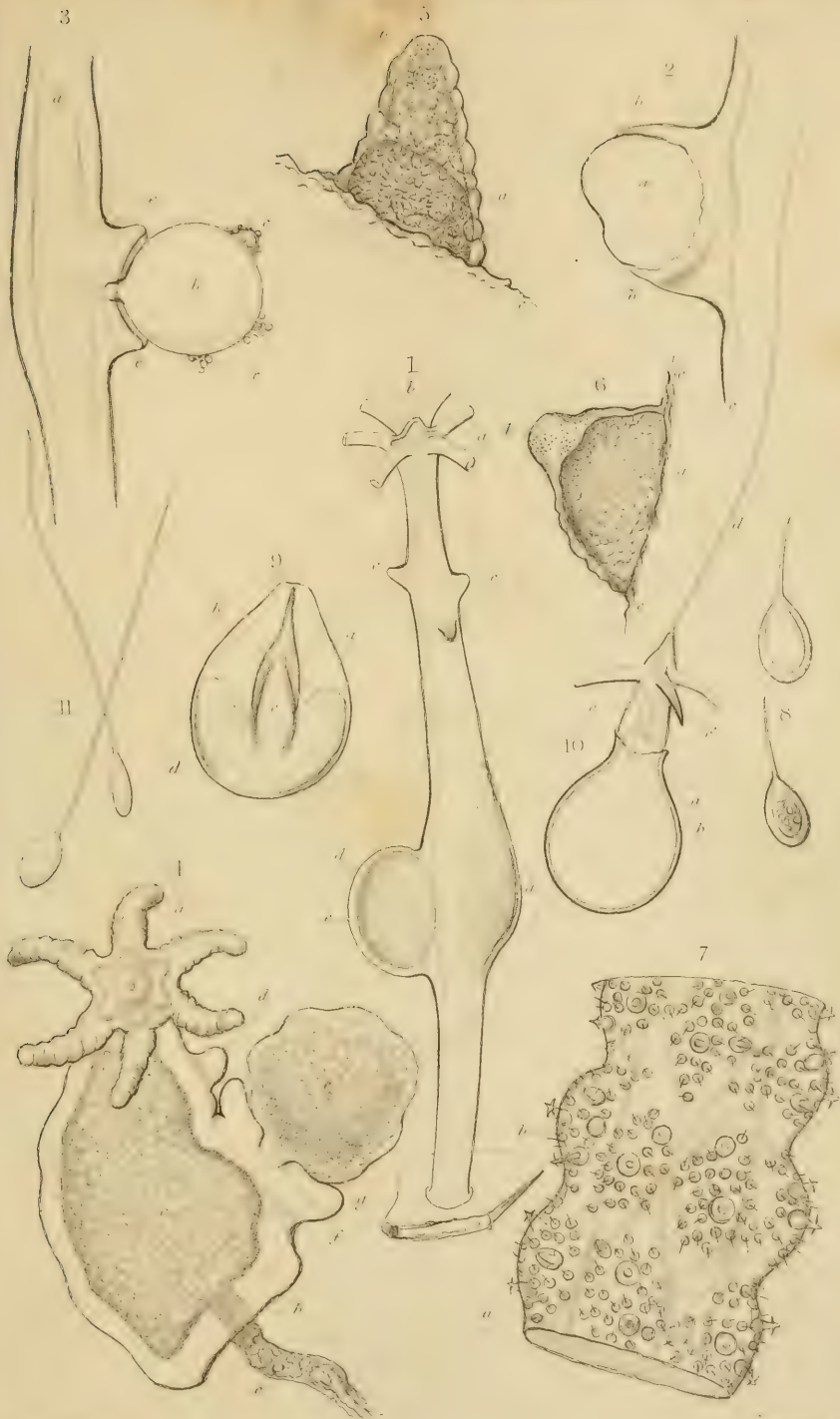
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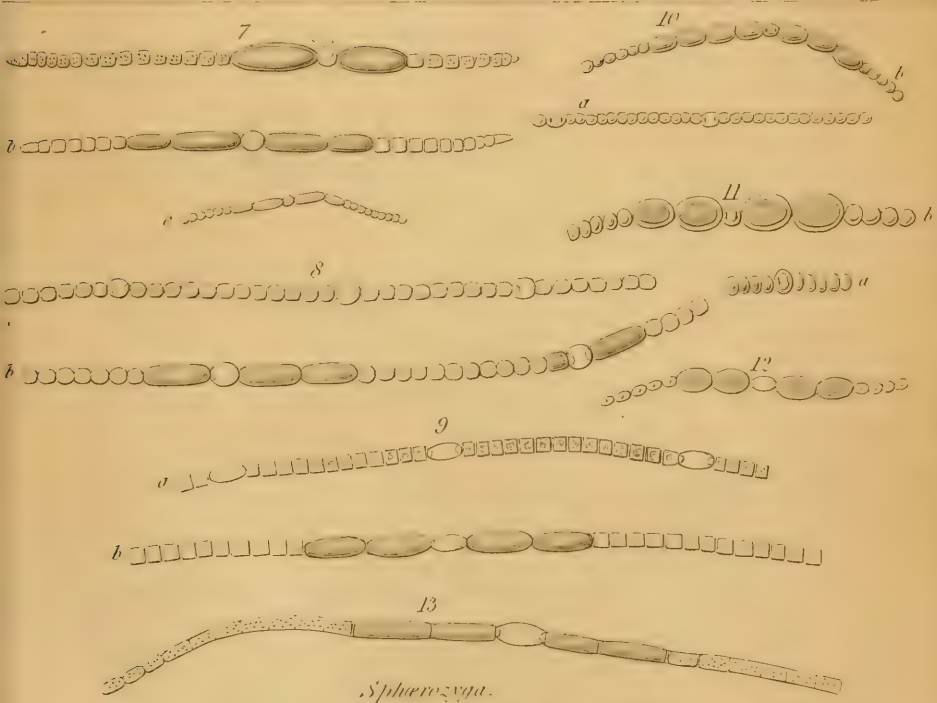
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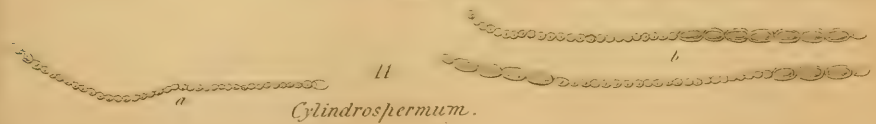


Monormia.

Trichormus.

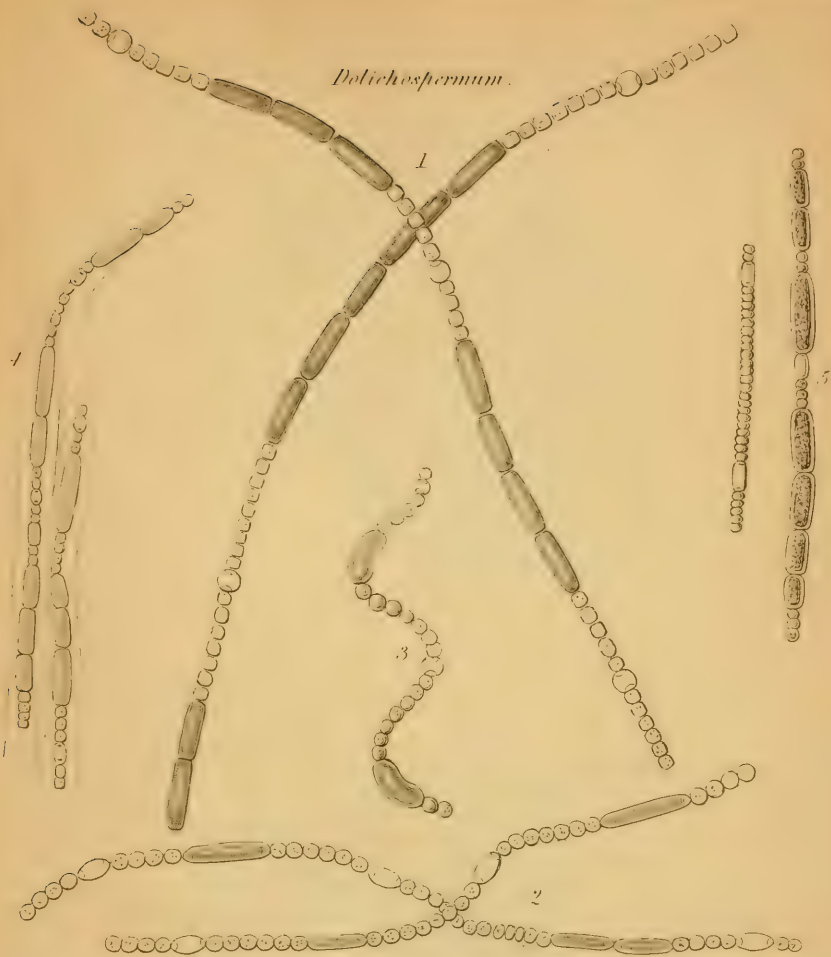


Sphaerovya.

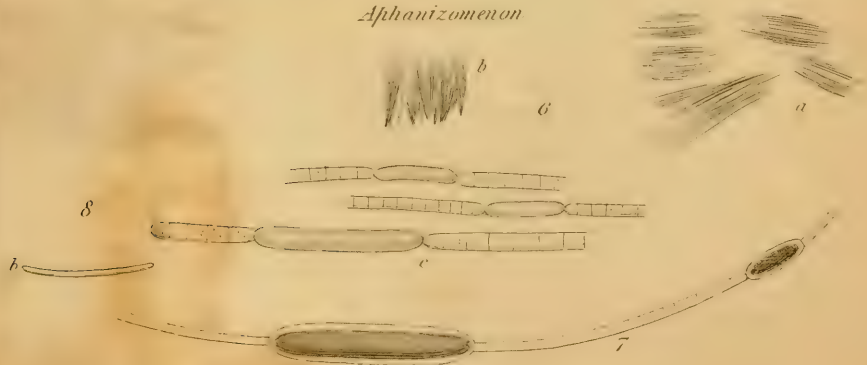


Cylandrospermum.

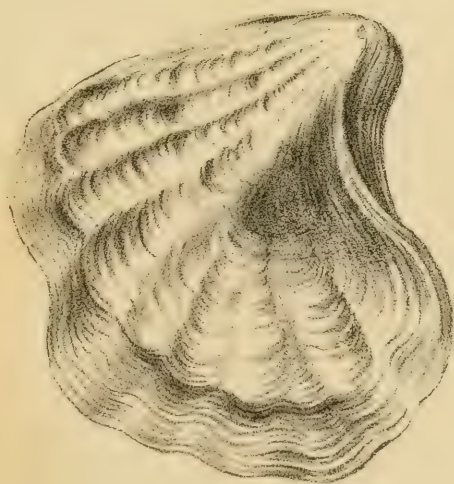
Dolichospermum.



Aphanizomenon





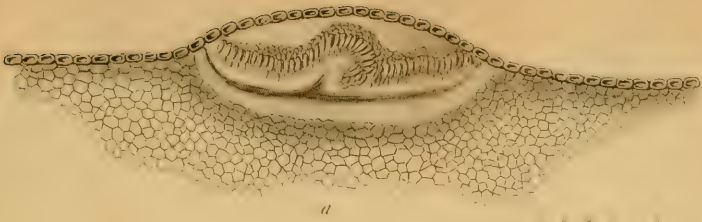


~Lycett. del.

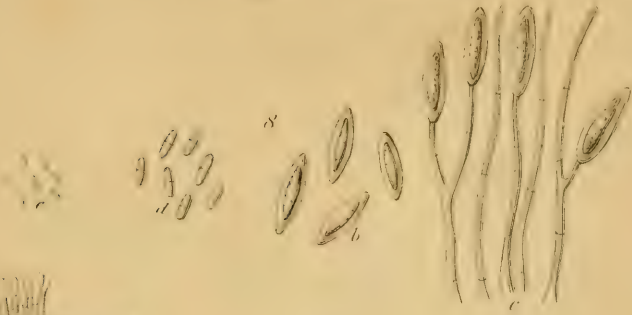
J. De C. Sowerby, in lap. del.

Modiolus, near Millington's form





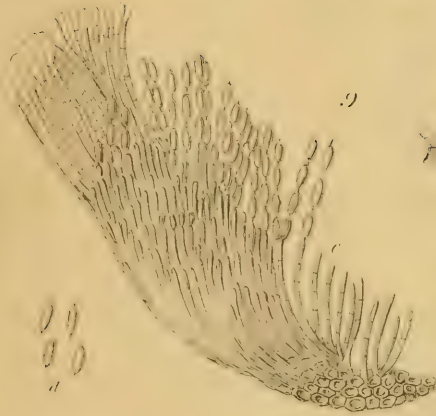
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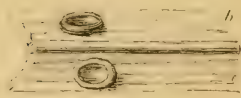
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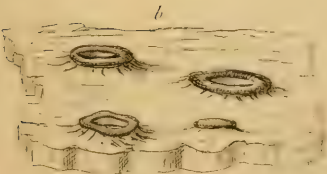


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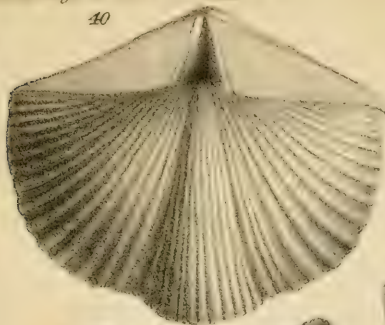


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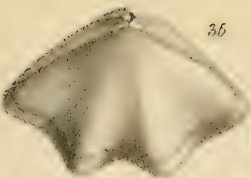
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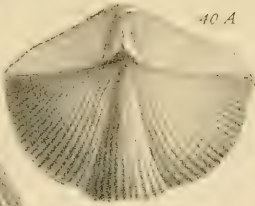
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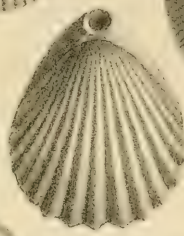
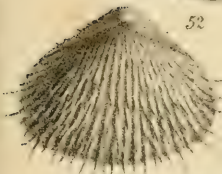
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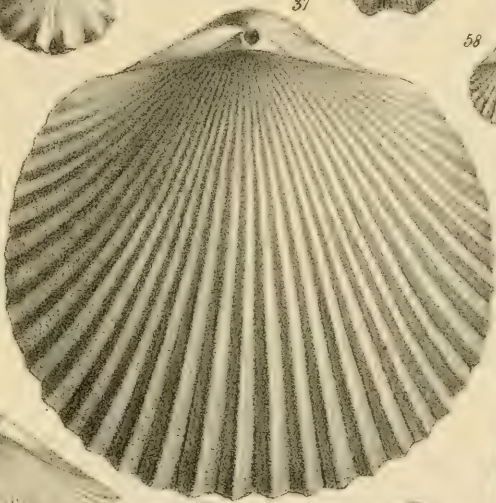
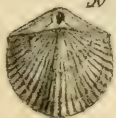
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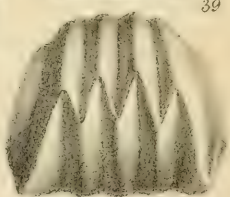
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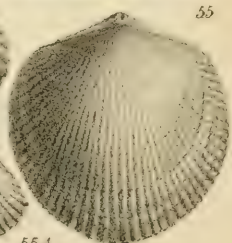
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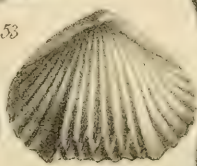
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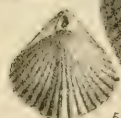
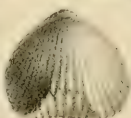
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